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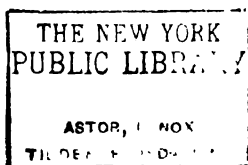
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Geo. W. Sternberg

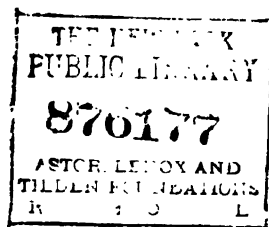
George Miller Sternberg

A BIOGRAPHY

BY HIS WIFE
MARTHA L. STERNBERG

CHICAGO
AMERICAN MEDICAL ASSOCIATION
FIVE HUNDRED AND THIRTY-FIVE NORTH DEARBORN STREET
1920

CL 157



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PREFACE

The following pages have been written in the sincere hope that the life and work of General Sternberg may serve as an inspiration to the present and future generations of American physicians to achieve renown in the science of preventive medicine.

To my near friends who have known of my efforts and have given me encouragement and sympathy, I desire to express my thanks. I am especially indebted to Dr. George M. Kober and Mr. Emile Berliner for aid and encouragement in my work, and to Drs. Fielding H. Garrison and Frank J. Stockman, both of the Surgeon-General's Library, for the revision of the manuscript for the press. Last but not least I desire to express my heartfelt thanks to the Board of Trustees of the American Medical Association for undertaking the publication of this volume, and also to Dr. George H. Simmons, the distinguished editor of its Journal, for valuable suggestions in the preparation of the manuscript.

MARTHA L. STERNBERG.

WASHINGTON, D. C.

MAY 20, 1920

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FOREWORD

This biography of General Sternberg is a historical record of especial interest to the medical profession and to the medical officers of the United States Army. Written by his widow, the companion and co-worker of his active life, it is authoritative. Of unusual charm are the chapters dealing with army life in the old days at the Southern and Western posts, a theme which has been usually dealt with only by our novelists. The record of the military and scientific career of the man himself is of permanent value.

The story of General Sternberg's life is one of arduous devotion to duty, of unflagging industry and of unexcelled patriotism. Entering the Army in 1861, at the age of 23, he served through the Civil War with courage and ability. It is said that he saw more active service on the battle field and in Indian campaigns than any other medical officer of his time. After the Civil War, he acquired an unusual experience in dealing with epidemics of cholera and yellow fever, and was himself a temporary victim of the latter disease. His interest in these infections led him to take up the study of bacteriology, in which he was originally self-taught. He was the pioneer bacteriologist of this country.

Through his books on the value of commercial disinfectants, on bacteriology, malarial fever, immunity and serum therapy, he was the earliest to teach American physicians the fundamental principles and technic of bacteriology, including the culture methods and photomicrography. In 1880, he discovered the micro-organism of pneumonia, before Pasteur announced his findings. He was the first in this country to show the organisms of malarial fever, cholera and tuberculosis. His researches on malarial fever and yellow fever made it clear that neither of these diseases could be caused by a bacterial organism. These negative findings were of the utmost importance in establishing the true causal relations in these infections. We can only appreciate the worth of such researches

in the light of Bacon's axiom: "It is easier to evolve the truth from error than from confusion." Before their publication, confusion reigned.

As Surgeon-General of the Army (1893-1902), Sternberg created the Army Medical School, organized the Army Nurse Corps and the Dental Corps, established the Tuberculosis Hospital at Fort Bayard, and many general hospitals during the Spanish-American War. His own early difficulties in acquiring the knowledge for which he thirsted led him to the liberal-minded policy of encouraging medical officers to engage in scientific research in laboratories established by him in the larger post hospitals. Similar aims resulted in the establishment by him of the Typhoid Fever Board (Majors Reed, Vaughan and Shakespeare), which gave us a new point of view for the prevention of this disease; and of the Yellow Fever Commission, headed by Major Walter Reed, who, with his associates, discovered that yellow fever is transmitted by a particular mosquito. The enormous gain to medicine and public hygiene through these discoveries is well known.

Finally, after his retirement from active duty in the Army, General Sternberg devoted the evening of his life to social welfare activities in Washington, of which his work on sanitary improvement of habitations and the care of the tuberculous was perhaps the most important. He was highly honored in his lifetime, a president of the American Medical Association and of many other important scientific societies.

The present volume has been revised for the press by Lieut.-Col. F. H. Garrison and Dr. Frank J. Stockman, both of the Surgeon-General's Library. Written as it is by a lady of the Army, about one of the most eminent of our Medical Corps, I cordially commend the book to the medical profession.

M. W. IRELAND,
Surgeon-General, U. S. Army.

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CHAPTER ONE

EARLY LIFE

George Miller Sternberg was born at Hartwick Seminary, Otsego County, New York, June 8, 1838. He was the eldest son of the Rev. Levi Sternberg, A.M., D.D., and Margaret Levering [Miller] Sternberg. His surroundings in early childhood made a lasting impression on him, and through life he cherished a fond memory of the beautiful quiet valley and of the hills over which he had roamed, made famous by the writings of Fenimore Cooper.

His father, born in Schoharie County, New York, in 1814, was the youngest son of John and Anna Sternberg, and was descended from one of the oldest Lutheran families of the Palatinate who settled in Schoharie and the Mohawk valleys at an early date.¹ Imbued with the desire for a liberal education, in 1828 he entered Hartwick Seminary, where he spent five years preparing to enter Union College. He possessed a remarkably active mind, was an original thinker, positive in his convictions and ready to pass intelligent judgment on a variety of subjects. He graduated from Union College with honor and from the Theological Seminary at Hartwick, and received the degree of D.D. from Union College. Later he was chosen principal of Hartwick Theological Seminary, and for thirteen years he imparted a new impetus to the institution and added largely to the number of students.

Margaret Levering Miller was the eldest daughter of the Rev. George B. Miller, D.D., especially learned in ancient and modern languages and in theology, and for many years professor of theology at Hartwick Seminary. Like her father, she was possessed of an unusual faculty in acquiring languages. At the age of 19, when she was married, she had a good knowledge of Latin, read German, Spanish and French with facility,

1. The first wheat was sown in Schoharie County in the fall of 1713 and was sown by Lambert Sternberg, in Gerlachs Dorf. . . . The first bench of Common Plea Judges in Schoharie County consisted of William Beckman, Adam P. Vrooman, John M. Brown, David Sternberg and Jonathan Danforth.—*History of Schoharie County*, p. 5, 606.

and spoke French and German quite fluently. She was also an accomplished musician and played well on the church organ when she was a grandmother.

From his mother General Sternberg inherited a quiet, unselfish, affectionate disposition which characterized him throughout his life. Certain of her physical features were also his—the dark hair, the shape of the brow, and the benevolent brown eyes. In physique and certain facial features he resembled his father. It has been asserted that “if you would give a boy a good education, you must begin with his grandfather.” If this be true, General Sternberg received peculiar advantages in this respect. On his father’s side he was descended from an enterprising, sturdy race, while on the distaff side, his grandfather and his great-grandfather were scholars of Moravian descent. His great-grandfather was a learned and devoted minister and teacher.

As a boy of 10 years, George Miller Sternberg was taken by his grandmother from Buffalo, N. Y., where his father was in charge of a Lutheran Church, to Hartwick Seminary. The climate had been too severe for the boy, and his grandmother wished to look carefully after his health. He remained for some years at Hartwick Seminary and became greatly attached to the family of his grandfather. When he was 12 years of age his father was called to be principal of the institution at Hartwick, and there the boy continued to pursue his studies. At 13 years he became restless and at his father’s solicitation obtained a situation in the book store of Mr. Elihu Phinney at Cooperstown, N. Y., where he remained for about a year. According to his recollection, he devoted every leisure moment to reading fiction, books of exciting character giving him the greater pleasure. When he was approaching his fourteenth year he returned home at the request of his mother to resume his studies at the seminary. In the course of his education he was always fond of mathematics, chemistry and the natural sciences. When first he went to Hartwick he began the study of Latin and German, but he did not at that age develop the fondness for acquiring languages which in past generations had been the pride of the family.

A large and increasing family and the small income which is the clergyman’s portion caused his father to think seriously at



1855



1859



1869



1876

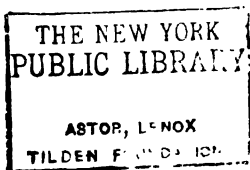


1880



1904

GEORGE MILLER STERNBERG



times of the financial situation. To George, the eldest son, the father had sometimes confided some embarrassing tribulations, and he began to feel the necessity of doing something toward relieving the situation. Accordingly, at 16 years of age, he took off his "round about coat," put on a frock coat and sought a school where he could teach during the winter months. He was fortunate enough to secure an engagement at \$10 a month and "board," in a small and uncomfortable schoolhouse in the hills 12 miles away. He returned home every Saturday, but separation from his mother for protracted periods was a great trial and he determined to do better the following winter. Through the influence of friends in New Jersey, he secured a school at a salary of \$20 a month, remaining for about two years, his salary being gradually increased until it amounted to \$100 a quarter. Having saved his money, he returned to Hartwick to continue his studies, and to teach in the seminary the branches of his preference, namely, mathematics, chemistry, and natural philosophy. About this time, he decided to enter medicine and began the study of anatomy and physiology under the direction of an excellent preceptor, Dr. Horace Lathrop, A. M., M.D., Cooperstown, N. Y. Through the kind assistance of Mr. Grandin Bray, a generous uncle resident in California, he was able to attend his first course of lectures during the winter of 1859-1860 at Buffalo. Later he went to the College of Physicians and Surgeons in New York City, where his expenses were again met by his uncle. Although this money was not sent as a loan, it was later returned by Dr. Sternberg to show his appreciation and with the hope that it would be again used to assist some other ambitious youth. He received his M.D. degree from the College of Physicians and Surgeons in the spring of 1860, and located at once in Elizabeth City, N. J., where he practiced medicine until the outbreak of the Civil War.

CHAPTER TWO

CIVIL WAR RECORD

At the call of his country, Dr. Sternberg appeared before an Army Examining Board in New York City and in a class of twenty-one he passed a very good examination and received appointment as Assistant Surgeon, U. S. Army, May 28, 1861. He accepted his commission May 31, 1861, and his first service was in the Army of the Potomac, with the command of Gen. George Sykes, from whom he received official commendation for courageous services during the battles of Gaines' Mill, Turkey Bridge, and Malvern Hill. At the Battle of Bull Run he was made a prisoner of war, as recounted in these extracts from his letters.

BATTLE OF BULL RUN

At half past two o'clock on Sunday morning, July 21, our division was aroused by the drum beating the call to "prepare to march." Soldiers and officers were soon moving about and breakfast was hurriedly eaten. Two days' rations were given to be carried in the haversacks. It was about daybreak when we got under way. After marching some distance beyond Centerville, our division under Colonel Hunter, which was in the rear, was marched in advance of the division which had previously been in advance of us. We then marched through the fields for some distance and afterward followed a road through the woods. When we came again into an open field, marching a short distance brought us to Bull Run above the place where the enemy had chosen their position. We heard the report of the cannon nearby, showing us that our troops in front were already fighting. We soon learned we were to be on the enemy's left flank. The men all took off their blankets at this place and left them in charge of the band and a small guard of men. We then forded the run and went at double quick time toward the field of action.

As we approached, we heard continuous volleys of musketry, showing that the engagement had become general. Our battalion of Regulars was in the rear of the column. Just as they were coming on the field Dr. Keeny rode up to me and said that Colonel Hunter was wounded and directed me, my assistant hospital steward, attendants and ambulance to follow him to attend to Colonel Hunter. We found Colonel

Hunter leaning against a tree with a wound in his neck which proved to be not serious. I saw that I could be of no use to him as there were plenty of surgeons around him. I therefore hastened with my attendants to find our regulars. We found the men just entering into action and some distance in advance of all others in our division. The enemy was driven before us for some distance and the number of their dead and wounded that we passed showed us that they had fought desperately. I kept as near our regiment as possible, picking up the wounded and putting on simple dressings and sending them in an ambulance to the surgeons in the rear. I attended to very many of the volunteers who were wounded, as well as to our own men, and as fast as possible sent them off the field in ambulances to a place in the woods where a number of senior surgeons had made their headquarters. Among others, I sent Lieutenant-Colonel Jones of an Alabama regiment, who was severely wounded in the thigh. At one time I got into the range of a battery and of musketry. The balls whisked about me in every direction. Thinking it useless to remain in such a dangerous position, I called my steward and attendants and we moved out of range of this battery.

The fight continued until 3 or 4 o'clock in the afternoon, when our troops began to give way and soon were in full retreat; in fact they became panic stricken. The retreat was a complete rout. The men would make no attempt to rally and many of them threw away their muskets and cartridge boxes, everything in fact, each one seeming to think of nothing but personal safety. Our battalion covered the retreat on the right in good order. In the beginning of the fight, I had tied my horse near a farm house that we were using as a hospital, and when I found that the battle was evidently lost and the retreat general, I went for my horse—but he was gone. I followed the retreating army to a church, where I found 280 of our wounded without any attention. I at once resolved to remain with them and do what I could to relieve their sufferings. Some six or seven surgeons of volunteer regiments also remained. We put out a white flag at once and commenced doing all we could under the circumstances for the poor wounded. I performed several amputations, hoping to save life.

CAPTURE BY THE ENEMY

About three quarters of an hour after the last of our men had passed, a company of the enemy's cavalry arrived at the church. The captain asked us for our parole not to attempt to escape from the church, which we gave. It began raining in the morning and as there was not room for all of the wounded in the church, a great many were obliged to be out

in the rain. The captain who first captured us had bivouacked near the church. I obtained a detail from him in the morning and started them to work to make a shelter. I had small trees cut down and a frame erected which was about 30 feet long and 20 feet wide. I covered this with blankets, and placed as many of the wounded as possible under it. On Monday evening, the captain told me he had received instructions to send us all to Manassas in charge of a lieutenant. Some of the surgeons went in ambulances, but I rode a horse that the captain furnished me. It was still raining and very cold. We had not had anything to eat since Sunday morning, except a cup of corn meal gruel which one of the men had made at the church. I was so chilled and exhausted when I reached Manassas that I could scarcely sit on my horse. After our arrival we were kept waiting in the rain for about two hours before it was decided what disposition to make of us. . . .

We were eventually taken to the guard-house where a number of other prisoners were confined. Luckily some of our men had brought blankets with them. I had none but one gentleman had three and he kindly loaned me one. We wrapped ourselves up in our blankets and lay down in a loft of the barn which was used as a guard-house. Notwithstanding our clothes were wet through, we were all sound asleep in a very few minutes. In the morning, a piece of salt bacon was sent to us on a piece of board. Shortly after partaking of this breakfast, a colonel came to us with a written parole in his hand which he said we might sign, and in case we did so we would be at liberty to go when and where we pleased. The parole was an agreement not to aid or abet the enemies of the Confederate States of America in any way whatever. Four or five of the surgeons took the parole but four of us refused to do so. Those who took it were at once sent back to the church to attend to the wounded we had been obliged to leave. Those of us who remained, earnestly requested that we might be allowed to attend to our wounded. A parole was therefore offered us which we gladly signed, not to attempt to escape or give any information for five days. Immediately after taking this we were allowed to go about the place at liberty.

We found a great many of our wounded lying in a shed near the railroad. Some of them had only just been brought in from the field, having lain all Sunday night, all day Monday through the rain, and Monday night. The poor fellows were in a most pitiable condition, many of their wounds were alive with infection of the worst type (maggots) and it seemed almost impossible to get the wounds clean. When we thought the infection was entirely removed we found on

the next change of dressing the wound was badly infected again. A train of cars stood waiting and our instructions were to dress the wounds as well as possible and put the men on the cars which would take them to hospitals at Charlotte and Culpeper. We had the train loaded by night and were told it would leave in a short time. We therefore went back to the loft in the guard-house to sleep, as no other place had been provided. In the morning, to our regret and surprise we found the cars were not yet gone, and the poor fellows had been lying in them all night without any attention. For some reason the cars were delayed all of Wednesday and did not get off until Wednesday night. . . .

On Thursday we continued to give our attention to the wounded at Manassas until evening, when a Dr. Taylor and myself were sent to Centerville to attend to some wounded who had been left there. . . . Dr. Taylor and myself had frequently talked over the chances of escape. We found an old atlas in a Dr. Alexander's house from which I tore a small map of Virginia. From this I ascertained that Washington was about east of Centerville. I told the doctor that the best plan was to go north for about 15 miles and then east until we struck the Potomac. By doing so I thought we should evade pursuit, and leave the secession troops all to the south of us. My parole was up on Sunday at noon. On Sunday morning Dr. Taylor was taken back to Manassas. I think the intention must have been to take me to Manassas as my parole had expired and Dr. Taylor's parole would not expire for two days to come.

ESCAPE

I took dinner at one o'clock at Dr. Alexander's and went to the hospital and saw that all the wounded were comfortable, slipped half a dozen crackers into my pocket, lighted a cigar and was all ready for my start. Thinking that the sentinels at the hospital might suspect my intentions when they saw me going towards the woods, I asked them if they knew where any real red oak grew, Dr. Alexander having recommended a decoction of the bark as an application for some of the wounds. The sentry said there was plenty of it in the woods about half a mile north of town. I then started in the direction of the woods, and as soon as I had reached it, I gave up that leisurely pace which I had taken so far for a more rapid gait. I came to a stream after walking about two miles, which I thought to be Bull Run. I took off my shoes and stockings and forded it; then continued according to my plans to walk in a northerly direction until nearly sundown. Then the sun which had been my guide became suddenly hidden by clouds and soon it began to rain. I was in a thick

wood of second growth pine trees which grew so close together that I could scarcely make my way between them. I kept traveling for about an hour in what I thought to be a northerly direction when I came to a small clearing in which stood an old house and a log cattle stable. I went into the stable until it ceased to rain. It cleared up just as the sun was going down behind the hills and I found when I caught a glimpse of the sun that I had gotten completely turned around while it was hidden by the clouds. I had been traveling on the back track. I therefore determined not to travel any more unless I should see the sun, moon or north star. After the rain, I skirted around the edge of the clearing to find whether the house was inhabited. Having become satisfied that it was not I went up to it and entered. There was nothing in it but a barrel and a door. I placed the door so that I might lie upon it, ate one of my crackers, smoked my last cigar, and threw myself down upon the door which I had placed upon an incline and I went quickly to sleep.

It seemed as if I had been asleep but a few moments when I heard my name called. I jumped suddenly up and said, "Well." There was of course no answer. I had been dreaming. On looking out of the window I found it was clear, and the moon had just risen. Accordingly I again took my line of march going as nearly in the right direction as I could. I found it extremely difficult at times to make my way through the thick underbrush by the dim light of the moon. I must have traveled until about 2 o'clock when it again became cloudy and I threw myself down upon the ground and fell asleep. When I woke up, the reddish tinge of the clouds in the east showed me that the day was breaking; I again traveled on east, eating blackberries with my crackers, as I went along, for my breakfast. I had avoided the open fields and houses all along but about noon seeing a man working alone in a field I went up to him to ascertain my whereabouts. He told me that by continuing about a mile and a half further east I would strike the Potomac River; that it was 12 miles to Washington by the road, and that there were a good many South Carolina troops along the road. I was very cautious in crossing the road and fortunately got to the woods on the other side without being seen.

When I reached the river, I took off my clothes and rolled them up into a bundle intending to swim across with the bundle in one hand, as I had often crossed the Susquehanna in my fishing trips at home. But my clothes being wet, were so heavy that I did not dare to venture, and I put them on and proceeded down the river, intending to construct a raft on which to cross. I had collected several pieces of timber and was looking for more when I discovered an old boat. I

unfastened it and getting into it let it float down with the current. This mode of traveling was so much pleasanter than walking through the woods, that I determined to continue it as far as possible. . . . My boat ride was stopped about five miles from Washington by a dam extending across the river which I could not get over. I accordingly landed on the Maryland side and proceeded on foot. The first house I came to belonged to a kind-hearted Irishman who gave me two large bowls of milk and a supply of good bread and butter, the best I think I ever ate. I learned from him that I was five miles from the city. Passing along a little farther I fell in with some soldiers of the 6th Maine Regiment. I inquired of them where I could hire a horse to take me to the city. After hearing my story they said if I would go with them to their camp, which was nearby, their colonel would send me in. . . .

When I arrived in camp I was aware that my appearance was anything but prepossessing. My clothing was torn and wet, and I was worn and weary. I was presented to the colonel. He promised to send me to the city in a short time. While I was talking with him, a soldier came into the tent and asked me if I was not the man he had in the guard-house the night before. I told him I was not, but he was very sure I was and called four men to prove it. They all declared that I was the very man—and I almost began to believe it myself. But one of the men happened to see me standing and concluded that I was at least a head shorter than my facsimile. The colonel seemed to forget his promise to send me to the city and after waiting for two hours it began to rain and I had to give up going until morning. One of the captains kindly offered me a bed in his tent and I remained with him over night. At five o'clock in the following morning I arose and walked to Washington. I had left my trunk before starting for the campaign at the house of Mrs. Boyle.

When I arrived there I hastened to refresh myself with a bath and some dry clothing. All my friends seemed rejoiced to see me. They had heard that while leaning over a wounded man on the field I had been struck by a cannon ball and killed. After a short delay I went at once to the house of General Scott to report. I was most kindly received by him and had a long conversation with him giving all the information on the situation that I could. I next reported to the Surgeon-General, after which I proceeded to join my regiment on Arlington Heights, where the regiment was in camp. I was most cordially received by all and you can well imagine my pleasure to be again with my fellow officers. In the afternoon, I reported to General McDowell with whom

I had a long interview. The following morning, our battalion was ordered to Washington to act as a police force for the city until the opening of the campaign in 1862.

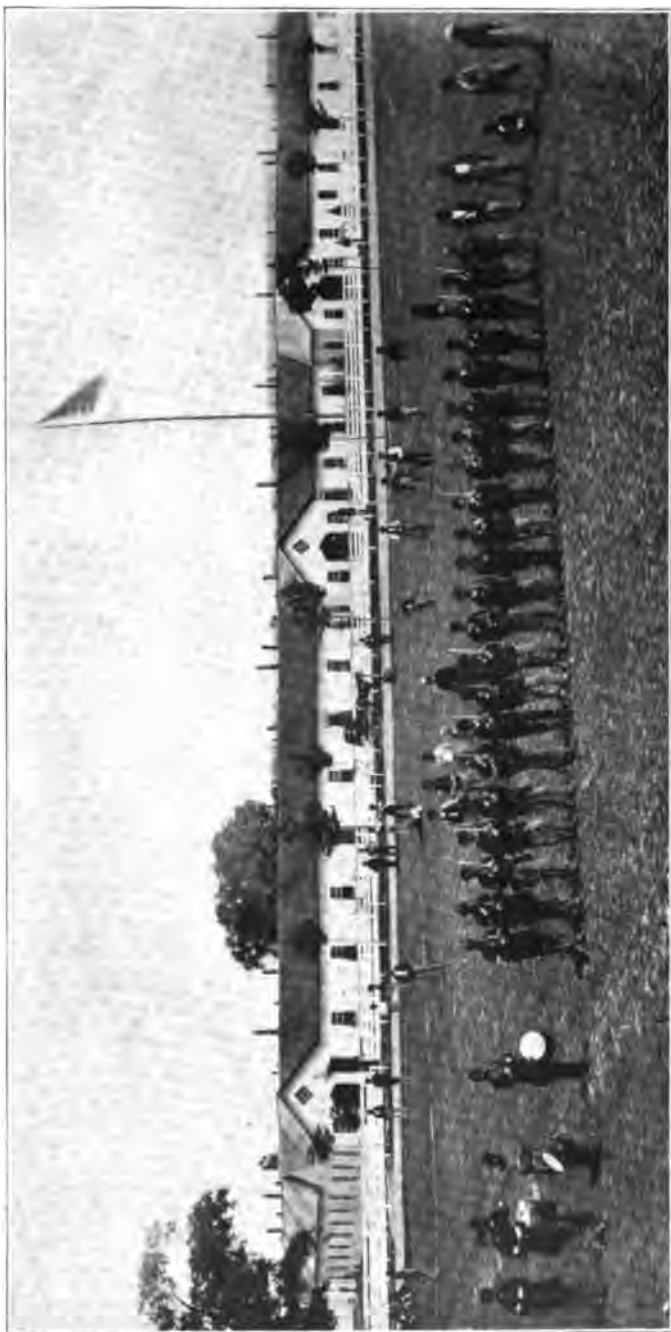
The official records show that Dr. Sternberg was under heavy fire while caring for the wounded in the battle of Gaines' Mill and Malvern Hill. Brig.-Gen. George Sykes in his reports of these battles, and the engagement at Turkey Bridge¹ says:

Dr. Sternberg added largely to the reputation already acquired on the disastrous field of Bull Run. He received the brevet-commission of Captain and Major for faithful and meritorious services during the war.

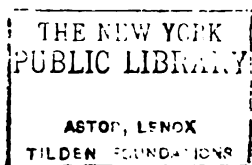
Dr. Sternberg was with General Sykes' command in the Army of the Potomac until August 29, 1862. He was taken sick with typhoid fever at Harrison's Landing and was sent north on a Government transport. Recovering, he was assigned as executive officer of the U. S. General Hospital at Portsmouth Grove, R. I., a hospital containing 2,200 beds. In November 1862, he was ordered to accompany General Banks' expedition, then organizing in New York City, to New Orleans, where he served as assistant to the medical director of the Department of the Gulf and with the board of health until January, 1864.

In 1864, he served as Assistant Medical Director at Columbus, Ohio, and was later placed in charge of a large and complete general hospital at Cleveland, Ohio. He was relieved from this post July 5, 1865 and the next tour of duty was with the Thirteenth Infantry at Jefferson Barracks, Mo.

1. War of the Rebellion Records 11: part 2, 352.



United States General Hospital, Cleveland, Ohio, 1864-1865.



CHAPTER THREE

AFTER THE CIVIL WAR

Oct. 19, 1865, Dr. Sternberg was married to Miss Louisa Russell, daughter of Robert Russell, of Coopers-town, N. Y. They went to Jefferson Barracks, where they remained until April, 1866, when he was ordered as post surgeon to Fort Harker, Kan. Mrs. Sternberg's health was frail and when the order came to go to a frontier post, Dr. Sternberg thought it best for his wife to return to her father and mother in the East until their future quarters were made in readiness. This she did and joined her husband in the Far West in the spring of 1867. June 28, cholera appeared at Fort Harker, the first cases occurring among members of a colored regiment temporarily at the post en route from Jefferson Barracks to New Mexico. There were, from June 28 to August 1, forty-seven cases with thirty-two deaths among the troops, besides a number of cases among civilian employees. Among the first cases in the civil population of the post was Dr. Sternberg's wife, who died July 15, after a few hours of illness.

In Dr. Sternberg's account of this epidemic¹ he says:

Many cases, that I am now satisfied were mild cases of cholera, were diagnosed at the time as choleraic diarrhea and do not appear in the above report, which only contains the clear and unmistakable cases.

Fort Harker is located on high ground about a mile east of the Smoky Hill River, at the junction of the Smoky Hill road to Denver City and the road to Santa Fe via Fort Zarah and the Arkansas River Route. It is 85 miles west of Fort Riley and since July 10 has been in railroad communication with the East by the completion thus far of the Union Pacific R. R., Eastern Division.

The elevation above the bed of the river is from 60 to 70 feet. The surface descends to the east, south and west, affording excellent drainage. The soil is but 6 to 8 inches thick and below is a bed of fine gravel, about 30 feet thick, composed mostly of quartz and flint; below this is a bed of

1. Surgeon-General's Office, Circular No. 1, pp. 29 and 30. Report on epidemic cholera and yellow fever in the Army of the United States during the year 1867.

clay. The bluffs north and east of the fort are composed of a recent red sandstone, which contains impressions of the leaves of trees of existing species (oak, ash, willow, etc.). The water used at the post is obtained from a spring in the bank of a creek one-quarter of a mile west from the post. The spring issues from the bank about 15 feet above the level of the creek, over the stratum of clay, above which is the gravel. An examination of the water from the spring in July, 1867, showed but a small trace of organic matter.

During the past year, diarrhea has been of rare occurrence among those who have been at the post for any length of time. During the month of June, 1867, but twelve cases of diarrhea are reported.

The garrison of the post where cholera first made its appearance, consisted of Company E, 37th Infantry (white) and Companies H, B, K, 38th Infantry (colored). The companies of the 38th Infantry had been recently organized at Jefferson Barracks and came from there here. . . . In addition to these troops Company H, 38th Infantry, and Company F, 10th Cavalry (colored) were temporarily in camp at a distance of from one-eighth to one-half mile from the post on high ground. Four companies of Kansas militia were mustered into the United States service and remained at the post about two weeks in July during the worst of the epidemic. There were also encamped at and around the post from 500 to 800 quartermaster's employees (masons, carpenters, laborers and teamsters). The number of these was constantly varying, many leaving in consequence of the epidemic, and others coming from the east.

The police of the camps was not good when cholera first made its appearance. Some of the companies' sinks were in a wretched condition, and there were several offensive holes about the post where slops and garbage from the kitchen had been thrown. Measures were at once taken to remedy these evils; a strict system of policing was inaugurated; the camps were all moved to new grounds and disinfectants were procured and freely used. . . .

The hospital patients were all treated in hospital tents, which were pitched about 50 yards in rear of the post hospital. Convalescents and uncertain cases were kept in separate tents from the cholera patients. The discharges from the patients were all disinfected as soon as passed.

The history of this epidemic shows that cholera was evidently introduced by colored troops who arrived at Fort Harker from Jefferson Barracks, where the disease prevailed to the extent of 256 cases with 134 deaths. In view of the fact that it is now believed that cholera, like other intestinal

infections, may be transmitted through the agency of flies, the following observation of Dr. Sternberg is of special interest. "There have been an unusual number of flies and mosquitos. Houses have been infested with a large fly which differs from the common house-fly."

INDIAN CAMPAIGNS

The epidemic being over Dr. Sternberg asked to be relieved from duty at Fort Harker and returned east on leave of absence in August, 1867. At the expiration of his leave in December, 1867, he was ordered to Fort Riley where he was post surgeon and on courtmartial duty.

March 23, 1868, he was directed to report to the commanding officer, Tenth Cavalry, for duty with that regiment on a march from Fort Riley to Fort Hays, Kan. These troops, under command of Major M. H. Kidd, did more or less Indian campaign duty. Sept. 25, 1868, he was assigned as chief medical officer to Col. A. Sulley's expedition in the field. This expedition was operating against hostile Indians south of the Arkansas and the district of upper Arkansas, with bases near Fort Dodge, Fort Hays, Kan., and Camp Supply, I. T.

Nov. 7, 1868, Dr. Sternberg pointed out that no medical officers were available to accompany trains between Fort Dodge and Fort Hayes or the new base of operations. He requested two additional officers, because "the trains will be liable to attack by Indians and accidents will occur to the drivers and the escorts while on the road. In one of the trains coming from Fort Hayes a few days ago, one man was killed and another severely wounded by a stampede among the mules. I happened to be on the spot and rendered the necessary assistance. I also found several men in the train disabled by kicks from mules. There is at present but one medical officer on duty with the Infantry Battalion, and two with the Seventh Cavalry, so that when companies are detached to escort trains, they have to go without medical assistance."

He was relieved from duty as chief medical officer of the troops serving in the field south of the Arkansas, Dec. 7, 1868, and assigned to duty with Maj.-Gen. Sheridan's command in the field depot and headquarters on the North Can-

adian River, at the junction of Beaver Creek, I. T. This expedition, like the others, was for the purpose of subduing the Cheyennes and other hostile Indians in and around the Indian Territory. There were naturally many alarms and exciting pursuits of the Indians, and on the whole Dr. Sternberg spent a trying winter in this almost unexplored country. During the marches that he made with the command, he became interested in the geological conformation of the country, made close observations and copious notes, and collected much material. His interest in gathering undescribed fossils and other animal remains resulted in frequent chidings by other officers lest he should be picked off by the Indians while securing these specimens. Some of his specimens were forwarded to Prof. Joseph Leidy, of Philadelphia, who described them in his report on "The Vertebrates of the West." The Indian crania, skulls of animals and birds, and fossil shells were sent to the Army Medical Museum and were acknowledged "to have been received in good order, being very carefully packed."

FORT RILEY

March 2, 1869, Dr. Sternberg was relieved from General Sheridan's command and ordered to proceed to Fort Hays, Kan., and on his arrival to report by letter to the Medical Director, Department of the Missouri, for assignment to duty. In the summer of 1869, he was again ordered to Fort Riley as the Attending Surgeon. This gave him a good garrison post, as it was then the school of light artillery. He had a fine hospital and a good working force; and there was a thriving town at Junction City, just two miles distant, where he could secure materials for making photographs and for other experimental work in which he was engaged at the time. It was my good fortune to begin my own army life at this delightful military post in the autumn of 1869.

I was married to Dr. George M. Sternberg Sept. 1, 1869, in Indianapolis, Ind. I am the daughter of Thomas Thurston Nelson Pattison, a prominent citizen and pioneer in Indiana, descended from a Scotch-Irish ancestor, who settled at an early date on the eastern shore of Maryland. My mother, Elizabeth Grant [Mauzy] Pattison, was descended from a French Huguenot who settled in Virginia. My grandparents

were early settlers in Kentucky. Both of my immediate grandfathers were ministers of the Gospel and left Kentucky because of religious convictions; they did not wish to rear their children in a state where slavery existed. Therefore, they returned the slaves given them by their parents when they were married and removed with their young families to the free state of Indiana.

After my marriage to Dr. Sternberg, we made a brief wedding trip and soon returned to Indianapolis in order that I might say good-bye to my parents and the friends of my youth. The happy moments spent with dear ones flew quickly and we started for Fort Riley, Kan., which was to be our new home. Even at that date the railroad accommodations in the Middle West were good, and we traveled through active and progressive states, namely, Indiana, Illinois, Missouri and Kansas. As a young lady, I knew all this section of my country very well, had visited relatives in Cincinnati, St. Louis, and other cities; I loved these neighboring states as well as my own, and felt sad at leaving for other fields. Our entrance into Kansas served to awaken a new instinct in me, and I studied constantly and carefully from the car the landscape which I knew would be different from that which we had just passed. Acres and acres of rich prairie land extended at times as far as the eye could see without the least obstruction of hill or dale. Some fields were under cultivation, others untouched awaiting the farmer who was yet to come. We passed some small towns and I was glad when I heard that our next stop would be Lawrence, the place where John Brown gathered his followers and made trouble. But there was no trace of this past event; it was just a quiet little town. Topeka, the capital city, was the next stop.

After Topeka there were fewer towns and the eyes everywhere beheld vast prairies. Soon we reached the railroad station at Fort Riley, at that date a modest little building at the base of the bluff, very different from the present one. An ambulance drawn by four spirited mules awaited our coming and soon carried us on our way up the steep incline. We were charmed with the fine substantial stone buildings and the general appearance of stability at the post. The site

was selected and the post built under the management of Major Ogden of the old U. S. Army. The officers' quarters, the barracks, the hospital, the stables—in fact, all the buildings at the post—were constructed of a cream-colored stone quarried close by. At this time Fort Riley was the school for the light batteries of the Army. All the drills, and the usual military routine, were vigorously pursued, for there was ample space for drill and for maneuvering on the parade grounds and surrounding reservation. After the usual duties of a post surgeon had been attended to each day, we enjoyed our second breakfast, and then took up some study or recreation, most frequently of outdoor character. We rode on horseback over the picturesque hills, whence could be enjoyed an extensive view of the valley of the Republican River with its cultivated fields and acre on acre of wild flowers. But the outings that were enjoyed most were those made to the prairies where we gathered quantities of wild flowers and grasses. We had to renew our study of botany to aid us in identifying the flora of our new surroundings. Sometimes we drove in our light phaeton to the neighboring village, two and a half miles distant, called Junction City from its location at the junction of the Smoky Hill and Republican rivers. The town had railroad communication with the eastern and western portions of the state by the Kansas Pacific R. R. and with the southern portion by the M., K. & T. R. R. It was the county seat of Geary County, and because of its banks and other sources of interest, constant intercourse existed between it and the garrison. The residents of Junction City were educated, ambitious young people, who were doing well their part in developing the natural resources of a rich state. The liberal professions were well represented and, on the whole, it was at that time an interesting and thriving place of some 3,000 souls. When Dr. Sternberg was selecting quarters, expecting me to join him, he knew his tour of duty at Fort Riley would not be of long duration, as he had served in that department since April, 1866. The demand for quarters was greater than the supply, consequently my husband gave those to which he was entitled by rank to a line officer who was not in robust health in order that his friend might be near his company and perform his

duty with less fatigue. We accordingly occupied quarters known as the sutler's house, built by a man who had accumulated a comfortable fortune from his post trader's store. The house was situated on an elevation and surrounded by extensive grounds; it was much too large, but it had its charms, of which the garden and the extensive view were not the least.

INVENTION OF ANEMOMETER

The many rooms gave Dr. Sternberg facilities for planning and developing ideas that were in shape for adoption and practical application. One room was used as a laboratory, another as a work room in other fields. Having a penchant for invention, Dr. Sternberg conceived the idea of improving the anemometer, an instrument in use at the hospital every day to register and record the direction and force of the wind. At that time the medical department of the Army was the official agency in this country for recording meteorologic observations. Having perfected his anemometer, when next in Washington he visited the Patent Office to learn if he had created anything new, and if so to apply for a patent. Much to his surprise, after searching some time, it was found that a German had worked on the same line in Germany long before this time. The anemometer was perfect, but the important part of his instrument involved the same principle as did the one made in Germany. This fact naturally entailed disappointment, but a sunny disposition precluded permanent regret.

In April, 1870, Dr. Sternberg prepared a report on the climate of Fort Riley, which was published in the local paper.

INVENTION OF HEAT REGULATOR

While at Fort Riley, Dr. Sternberg was also occupied with another important invention. Impressed with the desirability of maintaining an even temperature in hospital wards, he sought an automatic device to control the heating apparatus and constructed a thermometer to make and break an electric circuit. He perfected it and in 1870, when on duty in New York Harbor, displayed it at an exhibition of similar inventions at the American Institute, winning a medal and certificate. Not long after this, some men interested com-

mercially in such matters, communicated with Dr. Sternberg, and proposed to organize a company to introduce and manufacture his invention, but this required him to resign his commission in the U. S. Army. We talked the matter over, but I could not consent for him to give up his profession for a position that offered no other interests than building up a new commercial enterprise. While the matter was still under consideration fortune favored us and an order came directing Dr. Sternberg to Fort Warren in Boston Harbor, where other thoughts soon crowded out the business proposition. No further effort was made to commercialize the heat regulator or dispose of the patents, as our situation was not favorable for following up the matter. One morning, years after, a man called on Dr. Sternberg in Baltimore, saying he represented a manufacturing establishment in a thriving western city. He had learned of the invention of the heat regulator and he offered \$5,000 for the patents. Dr. Sternberg had become deeply interested in the study of yellow fever and bacteriology, and he naturally accepted the offer and proceeded to Washington with the purchaser to transfer the patents. They had scarcely left when another agent called with the information that he had been authorized to offer twice the agreed price. I told him I felt sure that Dr. Sternberg considered the sale with the other agent completed. Today this regulator is in general use, modified, perhaps, and somewhat improved, but the principle involved is that of his invention.

FARMING IN KANSAS

Fort Riley was always of special interest to me, because shortly after my arrival we made a visit of a few days with Dr. Sternberg's father and mother, who were living on a frontier farm in western Kansas. This trip to the family and the spot itself had much interest, for it caused me to know even then that Dr. Sternberg was a generous and unselfish man, as will appear from the following:

While stationed at Fort Harker, a frontier post in the early history of the state, some of the officers of the Army had secured quarter sections of the fertile land close to the post. Dr. Sternberg was especially fortunate in securing a

piece of land beautifully situated on the wooded banks of a little river about two and a half miles from Fort Harker. At the time Dr. Sternberg took up the land, his father was a Lutheran minister and president of a college in Iowa, and had not visited his son for years. Dr. Sternberg urged his father to make him a visit at Fort Harker and the invitation was readily accepted. The son was naturally pleased to show his father what he had done, and to talk with him of the plans for future development of the ranch. His father entered into the plans with zeal and interest because he was really in love with the situation, and several times he remarked what a splendid place it would be for the younger boys to develop. While Dr. Sternberg readily acquiesced in his opinion he did not think it a fitting place for his refined educated mother.

Shortly after his father's visit Dr. Sternberg was ordered to take the field in the Indian Territory. In correspondence, his father had expressed a desire to possess this farm in Kansas and finally made an offer to purchase it; but the generous son could not think of that. In a quiet and delicate way, he made it possible for the father to own the farm, notwithstanding he was not wholly in sympathy with the project; for he was devoted to his lovely mother who, he knew, had always enjoyed refined society. He said to me at a later date "I could not say 'No' when I thought there was a prospect that father might lighten the burden of life that had been his to bear for so many years of ministerial and college work on salaries never very large."

When his mother arrived, she expressed herself pleased with the beauty of nature and the mild climate. She made friends at Ellsworth and there were some settlers living miles away, representatives of good families in the East, who came to call. More settlers came and a town grew up not far away where Rev. Dr. Sternberg was asked to take charge of a church. The mother played the organ and taught in the Sunday school. With advancing years and fewer cares Mother Sternberg began a study of the wild flowers, which she painted separately and in bouquets, to impart to her Eastern friends an idea of the beauty and interest of the prairies. In fact, she kept up her accomplishments, music, painting and

correspondence, notwithstanding all the duties a loving mother finds in the care of a large family of boys.

Rev. Dr. Sternberg became recognized as one of the leading educators of Kansas. Years of prosperity and adversity alternated and while more acres were added and the herds of cattle, horses and ponies grew larger, the lot of the average farmer and stockraiser in the West was at that time far from enviable. These industries brought fatigue, and at times very little profit. Meantime the younger brothers were growing to manhood and wished for higher education. They were descended from a line of college ancestors and did not fancy spending their lives on a ranch. One by one they became interested in various professions and in business. Dr. Sternberg as the eldest of the family felt interest in the success of his younger brothers, and he gave them every assistance from his own salary.

Some years later, on a visit to the family before going to Europe, Dr. Sternberg said to me "Don't you think it would be nice to give mother a birthday present of a house in town, and give her the deed so that it will be entirely hers? Now that the boys are going away it must be lonely for her on the farm." I said, "I agree with you and think this would be just the time to do it." While we were visiting he told her to get a plan for just such a house as she desired, and she should have it for her home always. She selected a good plan and the house when completed was a great joy to all of us. The farm was later sold to become part of a cattle ranch owned by a large company.

GOVERNOR'S ISLAND

The order relieving Dr. Sternberg from Fort Riley took us east, and he was assigned to duty at Governor's Island, New York Harbor, where he was to be assistant surgeon. We arrived there June 23, 1870, and were greatly pleased with our new station and the novelty of our surroundings. It was a busy post, for at that time there were many military interests centered there. It was headquarters of the Department of the East, a rendezvous for recruits, with a permanent garrison to do military duty, and also an ordnance depot. The officers' quarters on the outside of Fort Columbus were con-

sidered good for the period in which they were built. The hospital was almost modern in construction and appointments, and ample for the care of patients at so large a post. The old fort in the center of the Island was used as barracks for the troops on garrison duty, the company officers occupying quarters in the inclosure. The large old antiquated fort known as Fort William Henry was used to house general prisoners from other stations. An interesting little church was always shown to visitors as an honored spot, and there were pleasant memories associated with the history of the post.

From our quarters, we enjoyed an extensive view of the bay and Brooklyn. The constant traffic on the water never failed to bring suggestions of life and thrift. The front of our quarters faced the parade grounds, and morning and evening we listened to the stirring music of the band and watched the splendid type of American soldiers step promptly and briskly to the commands of the officers in charge for "guard mount" and "retreat." A few months at Governor's Island passed quickly.

YELLOW FEVER

Early one morning in September, 1870, my husband returned from his duty at the hospital with an anxious, careworn look. I had known for several hours that he was watching a patient in the hospital with great care, making frequent trips to observe conditions. I therefore begged him to tell me the situation, to which importunities he replied: "I suspect we have a serious and unusual form of disease on the Island and I am doing all I possibly can to make an early and true diagnosis. I fear yellow fever." As the junior medical officer, he consulted frequently with the post surgeon, who was greatly puzzled, and they requested consultation with the physicians of the New York and Brooklyn health departments. The disease baffled the combined skill of all. That it was a malignant epidemic was certain from the rapidity with which the sick list increased and the fact that several patients died after a brief illness. At this important moment it became known that a surgeon on duty at West Point had seen yellow fever in Mexico during his service there. His

presence being immediately requested, he supported Dr. Sternberg in the provisional diagnosis and it was announced that the disease was yellow fever. Meantime all the medical men who had been called in consultation had learned of the progress of the disease and agreed that it could be no other than yellow fever.

As soon as it was announced that yellow fever was spreading over the Island the greatest consternation prevailed. New York immediately quarantined against Governor's Island. The sick were ordered to the West Bank Quarantine Hospital far down the bay. My husband was detailed to accompany them and a steamer was immediately sent to transfer the patients. Neither Dr. Sternberg nor I had ever had yellow fever at that time. I saw the steamer arrive and watched the taking of the sick (eighty patients), each one covered closely with a sheet and carried on an iron bed. When all was in readiness, my husband ran to me and said: "Be a brave little woman. I will come soon to care for you." Suppressing my emotions for his sake, I bade him a hasty good-bye, ran quickly to the second floor of my deserted home, and threw wide open the large windows that overlooked the bay. I had not long to wait. The boat had already steamed up and soon shoved off. As it passed, I saw my husband alone well on the bow of the vessel, waving good-bye to me.

In a very short time, I was made to realize that I had cares and duties which I would have to meet alone. Many new patients were stricken, increasing the care and responsibility for Dr. Sternberg, as all the patients among enlisted men were sent to the quarantine. The chaplain, who occupied the quarters next to ours on the east, was suddenly attacked, and quickly succumbed. He did not report his illness at once, thinking he was suffering from fatigue and exhaustion and that rest would restore him, but alas, it was too late when he did call for aid. My dear friend and neighbor, the wife of the chief surgeon, was at this time very ill. She thought she was hopelessly ill and asked to see me to say good-bye. I went to her room and said as many cheerful, hopeful things as I could, then I came away. On my return I found the commanding officer standing at my door. He was apparently glad to see me, and said, "There is a small boat just off

our landing waiting for an answer from you. Dr. Sternberg has communicated with a cousin of his, asking him to come and take you and your maid with him."

The commanding officer seemed very anxious to have me go, and I replied that I could not think of going. I felt it my duty to myself to stay where I could hear from my husband. The boat came and went every day at the quarantine station and I would at least receive a letter. To all of which the commanding officer finally answered, "You really must go"; and then he told me that Dr. Sternberg had requested that the garrison be sent from the infected island to a clean new place, David's Island, N. Y. H. My appeal that we were quarantined by New York and would be subject to arrest brought forth only this comment: "We thought of all of that; my barge will take you and your maid over to New York at 11 o'clock tonight; your cousin will meet you at the Battery with a carriage; you will get immediately into the carriage and proceed to get out of New York state as quickly as possible." With his promise that he would look after our house, I consented to go. I left silver, china, everything, just as it was when we were at home. A medical officer, a friend of ours, arrived before I left, and took our house and quarters. He had scarcely become settled when he was seized by the terrible disease from which he never fully recovered. Two prisoners (with ball and chain) were detailed to take care of him, the house, and the garden. I am happy to state that one of the men proved a capable caretaker and good nurse, so much so that he was rewarded with a remission of his sentence for faithful and considerate service during the epidemic.

We were met by Dr. Sternberg's cousin, a prominent citizen and prosperous merchant of Newark, N. J., at the appointed hour and place and arrived late at night at his home. In order that our cousin should not get into trouble with the health authorities of his city and as a proper precautionary measure my maid and I kept to our rooms for quite a while. When I felt the maid was in no danger from the disease or of conveying the infection to others, she was sent to her home, and I grew bolder and mingled with the

family like any other guest. After weeks of hard, anxious service at the quarantine, I again saw my husband; while in New York on business he made a flying visit to see me. He showed plainly by loss of flesh and color how great had been his care and anxiety. I said at once, "I cannot let you go back alone," to which he replied, "I cannot take you with me." But by much pleading I finally gained my point; we went to Staten Island, met the boat from the quarantine station and were soon across the bay and approaching the island.

As we drew near the wharf, I could see convalescent soldiers, who showed in every way evidences of suffering from a serious illness, while on one side of the wharf was a large stack of new coffins. The quarantine officer met us cheerfully and seemed really glad to see me, remarking that it had been very lonely for my husband. (Thinking again over these situations, I cannot help feeling that my husband was at that time as much of a hero as any general commanding a campaign. A general in battle fights his foe in the open; a medical man has to fight the invisible foe of infectious disease, lurking in the darkness, always in hidden and unexpected places.) The wife of the officer at the quarantine station was a gentle little lady who welcomed me cordially, and did everything to make my stay on the island pleasant. My husband spent a great deal of his time with his patients, with his microscope and in writing up his bedside notes. I learned much from asking questions when we were walking or sitting in our room, for Dr. Sternberg was always ready and willing to converse with me on subjects that interested him and he was pleased to have me take an interest in his professional work. After the first frost, in October, we returned to our home at Governor's Island and found everything as we had left it. We had lost only our mattresses, bedding, rugs and some other things, for it was then the custom to disinfect with "fire and brimstone." The autumn season of the year is always sad for me, but it seemed doubly so that particular year on account of the many vacancies and changes in the personnel of the garrison. We spent a very quiet winter at Governor's Island and really welcomed an order which took us to Fort Hamilton, N. Y. H.

FORT HAMILTON

Fort Hamilton guards the entrance to New York Bay at the Narrows, and is directly across the channel from Fort Wadsworth on the Staten Island side. It has no artificial defenses on the land side, but on the side facing the Narrows are elaborate earthworks covering the emplacements for the guns, which are of 6, 8, 10 and 12 inch caliber, and their magazines.

On the whole, it was a delightful post with the First Artillery for the garrison. The quarters were comfortable and we were situated near the hospital. The officers' quarters were widely separated; some in the old casemates, others outside on the driveway and elsewhere. We enjoyed the two months we spent at Fort Hamilton and warm friendships were formed which lasted for long years.

FORT WARREN

The time seemed short before an order carried us to Fort Warren in Boston Harbor, nine miles down the bay. When we arrived there, June 30, 1871, we were given a warm welcome by the officers of the Fifth Artillery and their wives. The officers' quarters were in the casemates, of historic interest, for it was here that Confederate officers of high rank were quartered as prisoners during our Civil War. The surgeon's quarters were in the quadrangle, close by the hospital and near the quarters of the commanding officer. The hospital was a very good one of its kind, but since it was also in the casemates it had very little sunlight.

Every medical officer stationed at these forts has reported against occupation of the casemates as quarters. They are damp and cold, and would cause much sickness, if fires were not constantly kept in them. Arms rust in their leather when there are no fires, moisture bedews the interior of the walls and trickles to the floor, well accounted for in the explanation of General Warren in 1874.

The casemates are arched with bricks, the arches covered with sheet lead, and the valleys between them filled with earth. A thin layer of concrete with a brick pavement over all completes the roofing. The weight of the covering above the lead presses the hard parts through the sheet metal, and thus permits water to reach the arches and soak from the valleys into the interior of the casemates. Moreover in winter the case-

mates become chilled throughout, and retain a low temperature far into the summer, as has been shown by the presence of ice in the valleys when uncovered for repairs.

Dr. Sternberg spent the morning hours doing professional work at the hospital. Later on in the day he did professional reading or reading on such subjects as heredity and the influence of environment. This post was at the time in charge of the Engineer Corps of the Army for repairs and improvements. There was only one company of troops at the post to do military duty, and two ladies beside myself in the garrison. The bachelor officers were very kind and courteous and often we had invitations to the officers' mess to dine and enjoy music in the evening. One of the officers played a good accompaniment on the piano, Dr. Sternberg played the flute well, and I played a Spanish guitar, which had been given me by my mother. With the coming of the spring, one of our pastimes was to take our books and sit on the parapet, watching the ocean steamers go and come. Then for relaxation there was always fishing; we caught fish from the wharf or from the rocks near the beach.

In partnership with one of the officers we purchased a small sail boat. My husband as a boy spent many years near the Susquehanna River in New York state and he knew how to handle a boat and manage a sail. We sailed often over to Nantasket and the other seaside resorts, while the trip to Boston was usually made on the boat used for the purpose by the Engineer officers in charge of the work on the fortifications. This boat made but one trip a week and, in order to be independent, we purchased, with another officer, an interest in a larger boat. In this boat we sailed or rowed over to Hull just across the channel, where we took one of the large excursion boats making regular trips to and from Boston to the seaside cities.

NEW ORLEANS

July 22, 1872, an order came for Dr. Sternberg to proceed to New Orleans, to relieve an older surgeon who wished to go north to attend to some business and to spend the summer. Upon our arrival in New Orleans, we were met with the information that there was yellow fever in the city. General Emory was in command of the Department and he advised us to

arrange for board with a lady who had taken good care of him. This we did and I remained at home and roamed in the garden, read some interesting books, and took exercise in fanning myself instead of walking outside of the premises, until we knew what parts of the city were infected and to be avoided.

Dr. Sternberg was a busy man, he found much to do in the office of the medical director and in his quest for knowledge of yellow fever.

The evenings we spent at home; sometimes we sat on the veranda, at others, we read aloud and discussed our reading. But the mosquitoes were very bad and annoyed the doctor so much that one evening he lost interest in the reading, and he felt he could not do anything that would be more appreciated than to kill mosquitoes. He was quick in his movements and soon had a goodly number lying on the marble top of the bureau—to count them when the sport of killing should be over. In a few moments we saw something moving near the dead mosquitoes—we watched carefully the movements of a train of ants. They had come in great numbers and hastily formed two lines, one going and the other returning and soon carried away the dead mosquitoes, all except the wings. They evidently had ability to communicate and command for they had in the quickest and most efficient manner carried away all remains of the mosquitoes. We had witnessed a demonstration of intelligence in the ant, that led us to want to know more, a desire which we soon gratified by reading Lubbock.

CHAPTER FOUR

FORT BARRANCAS

September 2, 1872, we arrived at Fort Barrancas, where Dr. Sternberg served as post surgeon for the next three years. The post is 9 miles from Pensacola down the beautiful bay. We found the Fifth Artillery under orders to proceed north, and the troops were busily engaged in packing and preparing for the move. The First Artillery was to relieve them and was anticipated at any time. We hastened to get settled in our new home, for we had friends coming, and at that period in our history army courtesy and kindness were proverbial.

Barrancas was not an attractive post. The officers' quarters were new frame buildings, neither well planned nor well built. We chose a set of quarters near the hospital; the house was surrounded by a wide porch which added to our comfort during the summer season. From the front we had an extensive view of the beautiful bay. At times the limpid water came and went in ripples over the clear white sand on the beach and the sky above was as blue and cloudless as an Italian sky—a view both restful and refreshing. The bar at the entrance was always lively with breakers foaming over the reef, and the distant Gulf was grand in its great expanse. Immediately across the bay from Barrancas was old Fort Pickens with an ordnance sergeant as the sole keeper of a once important fortified position. To the left of the entrance to the harbor stood the picturesque remains of the old fortification known as Fort McRea. We went often by boat to fish near this ruin or just back of it in the lagoon. Returning up the coast we passed a fort known as the old Spanish Fort, a most interesting place with many features considered important at the time it was built, now perfectly out of date and of no use whatever. This fort was not far from the hospital and its gray walls and green slopes looked picturesque and inviting from the bay.

The hospital was a wooden structure situated at a considerable distance from the company barracks. It was on the brow of a bluff some 30 feet high overlooking the bay. There were no trees nor shrubs to shade it, but the green slopes of the old fort afforded a little relief for the eyes of the patients.

We were more fortunate than most of the residents of the garrison, as in the grounds surrounding our quarters there were a number of trees, one large magnolia, one Pride of India, and several chime ball trees. After we were settled in our new home, our first and greatest desire was for the relaxation and pleasure of planning and cultivating our garden. We had no grass, nothing but sand on which to step after we left the board walk. This board walk led to every house in the garrison and had been constructed to keep the children and dogs from the "burr grass." We soon learned that a kind of blue grass could be cultivated if one could procure soil and give it care. My husband therefore contracted with the captain of a little schooner that came from up the bay to a neighboring village to bring us some soil. We cultivated not only grass but all kinds of blooming plants and very small fruits, which lent an interest to a life that might well have been uninteresting and tedious.

About one mile distant from Fort Barrancas was a little village populated principally by married clerks and employees of the Navy Yard, day laborers, pilots, fishermen, laundresses, shop-keepers and others. This was known as Warrington. Another village just beyond the Navy Yard and comprising the same class of citizens was known as Woolsey. The Navy Yard was once a manufacturing yard of some importance, but a great part of it was destroyed during our Civil War. However there were considerable life and activity there during the three years we spent at Barrancas. Warships came in for supplies and slight repairs and the ironclads were towed down there to go out of commission and to be wholly retired. It was quite an event when they came in, each in tow of an active warship. There were dinner parties on ship and on shore and large evening parties at Pensacola and Barrancas.

In the early autumn, Dr. Sternberg received an order to report for temporary duty in New Orleans. The duty was for a short term and I therefore preferred to remain at home. As our house was at some distance from the other quarters, my husband had exacted a promise from one of the servants that she would never leave me alone, particularly at night, and he also left a revolver loaded for my protection in case of trouble. All went well for several nights, when suddenly, late in the night, we were awakened by concerted cackling in the

chicken house. I had purchased some fine bred chickens to interest me in something, although I knew very little about poultry raising. By some unknown accident the chickens had gotten out of their house and were running for life through the grounds. Expecting to see a thief, I was amazed at the spectacle which I beheld: a fine fox with a great bushy tail amusing himself by catching the hens and allowing them to go free after a few moments of torture. My maid said: "Please shoot off the pistol, that will frighten the fox away." But that would also frighten the officer of the guard, and cause excitement in the garrison, and someone would come running to see if I was in real trouble. The fox kept up his sport until daylight and when we went into the yard in the morning there were feathers flying in all parts of the grounds and many of my beautiful hens had gone to feed the foxes. On the return of my husband from New Orleans, he brought me a well bred horse named "Robert E. Lee" and a phaeton, which proved a source of great delight for both of us.

As I review the past, I often think that one reason why my husband accomplished so much in life was that he always had a system in his work. The morning hours he spent at the hospital, or perhaps in consultation with the doctors on serious cases at the Navy Yard, or in one of the villages. For rest and relaxation we took drives to the country in search of flowers and of new interests in plant life. Growing abundantly on the edges of the swamps in Florida, there are two interesting varieties of the pitcher plant, and the inconspicuous "fly catcher," which kills its victim by a poison and absorbs sustenance by clasping between its petals and digesting the fly. The whole atmosphere seems filled at times with the perfume of the jessamines and other tropical flowers. These little excursions were exceedingly interesting, because we found many new varieties of flowers and grasses, and the change was a rest for Dr. Sternberg.

During the hours spent in the open, we did not seriously mind the many kinds of insects and reptiles flourishing in these parts. We became so accustomed to the sight of the moccasin snakes under the board walk, of the little slender snake that crept up the lattice work around the porch and even up the window shutters, that they engendered little fear. But

the king of all pests, the most persistent and annoying of all, was the mosquito. We could not be comfortable anywhere in the evening without using a large palm leaf fan so briskly that the mosquitoes could not approach us. We finally planned and constructed on the porch a little shelter, covered with fine net (wire for insect screening had not been introduced at that time) and here we could be assured of some degree of comfort.

The problem of getting fresh milk was very hard to solve and quite expensive. We had engaged milk from a woman living in Warrington. The boy who delivered it was constantly meeting misfortune and would arrive often with much less than I expected. The contractor, who furnished the beef to the post inquired if I was getting everything I desired. The time seemed propitious to ask him if he knew where I could get a good cow. He frankly told me he did not know of any I would call good, but he had a native cow with a calf, that he would be glad to bring me for no other remuneration than her food—adding that she would have to be taught to eat, since she knew nothing of cultivated food. This was a rather appalling prospect, but he volunteered to show the stable man the process, and as I had never seen a cow that did not know how to eat, I consented. Late in the afternoon of the next day, the cow was delivered, and our stable man with the assistance and guidance of the contractor, took a wisp of hay and dipped it into the corn meal or bran, forced it into the mouth of the cow, holding her mouth closed for quite a while. She did not relish the food, never having tasted anything like it before. The process of securing the milk was to her wholly new, and at times wildly exciting. It required two men to hold the calf, while the other secured what milk he could for us. This lasted but a few days, however, for one evening the cow became excited and kicked the calf, breaking its leg in her frenzy. The contractor when informed of the accident took it very philosophically and substituted another cow without calf. This cow also did not know how to eat any kind of corn meal, bran or hay and she did not wish to learn. Having no calf she never came home; she was very small and went so far into the swamp land to browse that the man could not find her at times. We learned that she likewise had a temper out of proportion to her size. It had been clearly demonstrated that the man

could not manage her and we got very little milk. I thus acquired considerable information in regard to the small breed of cattle then thriving in Florida. They existed on grass and green twigs and they furnished the residents of that section of our country with fresh beef and perhaps would have yielded a sufficient supply of milk if we had considered nature's provision for the cows of that latitude. Men had not at that date been interested in trying to import any other breed into Florida.

The summer months at Barrancas were not to be dreaded on account of the heat. The early mornings and evenings were comfortable under cover; the breeze from over the bay was always refreshing. The white sand on our extensive beach looked cool and clean. We early learned to get our exercise in the freshness of the morning hours; after nine o'clock we did not go in the sunlight except on business of importance.

YELLOW FEVER AT BARRANCAS

One morning, late in the summer of 1873, Dr. Sternberg returned from "sick call" at the hospital looking troubled and anxious, and when I asked him the cause of his anxiety he replied "I have a very sick patient about whom I am extremely anxious, I am almost sure he has yellow fever." There had been no cases that season in Florida, none nearer than New Orleans. All the rest of the day, he made frequent visits to the hospital. The next morning he expressed a desire to go at once to the hospital, but I said, "You must not go without a cup of hot coffee," and I ran to the kitchen to hasten the serving. On my entering the kitchen, the cook, a soldier's wife, said to me "I have been up all night, my children are very sick, will you please ask Dr. Sternberg to see my children." I hastily told my husband, who went immediately to the hospital. After a short time, he returned and said to me, "Please send the cook home at once to take care of her children as they are very ill with yellow fever." The woman had not reported the illness of the children, thinking she could care for them herself, and there had been no cases of fever that season.

Dr. Sternberg went at once to the adjutant's office to report the existence of yellow fever, and knowing from previous

experience the good results obtained by moving troops from infected localities, he recommended the immediate removal of the garrison across the bay to a camp near old Fort Pickens. The order was issued at once and there was "gathering in hot haste." Everyone was soon packing and on the move. We had only one steam tug and one sloop for transporting the command, but frequent trips were made and the commandant at the navy yard sent a larger tug to assist in getting the baggage and camp equipment over. Before that day had passed all were on the other side of the bay, with the exception of the commanding officer (who had previously had an attack of yellow fever in Mexico), Dr. Sternberg, myself, one company officer ill with a light attack of typhoid fever, the hospital steward, the nurses at the hospital, and some enlisted men to care for the animals at the quartermaster's stables. Dr. Sternberg decided it would be advisable for us to take a few things and go over to the quarters adjoining the officer convalescing from typhoid fever, in order that we could look after his comfort and diet. For several days a few patients returned from Fort Pickens to the hospital; all of these men had been previously infected, twelve cases in all. The beautiful children of our cook died very quickly, as did also the first patient in the hospital. The troops remained at Fort Pickens until after a light frost in the autumn. Everything that could be of possible service in cleaning and disinfecting was ordered done by Dr. Sternberg before the troops were allowed to return. My husband exerted every means to trace the source of this infection and made everything a matter of record.

I had spent the previous summer months in Florida because the breeze was fresh and cool, and the early morning hours were delightful. But I had promised to make a visit to my parents, and I went north in 1874. During my absence there were two cases of yellow fever at Barrancas. The first intimation of this came in a letter from my husband when he told me that he had been to the Navy Yard in consultation and that they were having yellow fever there. While at the Navy Yard, Dr. Sternberg was asked to inspect the whole command as he had recently had experience with yellow fever. In the hospital he found a number of pronounced cases, and some of

the officers were also sick. Dr. Sternberg visited all the patients with the surgeon of the yard, and was emphatic in regard to the diagnosis of yellow fever. A vessel had come in a short time before from the Isthmus, where the Chagres fever was then prevailing. The doctors who had seen Chagres fever (a malignant type of malarial fever occurring along the Chagres River in South America) were inclined to think it was that disease, but Dr. Sternberg's previous experience enabled him to feel certain of his point.

He therefore visited the admiral commanding the Navy Yard in company with the other surgeon, and recommended that all well people should be taken at once from the infected yard to a spot free from the infection. The admiral was a charming gentleman of the old school, but could not be convinced that the situation demanded such drastic measures. After a long consultation in which my husband appealed to him in every way he could to give the order at once, the Admiral finally said, "I can not give such an order, it would seem cowardly on my part, it would be equivalent to deserting the ship." A little later he became a victim of the disease and passed to the Great Beyond. The surgeon and his wife died, leaving orphan children; the paymaster and his wife recovered but were a long time convalescing; the captain of the yard and his wife died leaving orphans, and many enlisted men died in the hospital. My husband, although he was not immune, went to the assistance of the suffering and freely gave advice and medical attention.

After the frost had come, he invited me to return. Traveling in the South at that time was full of disappointment, as railroad connections were uncertain, and Dr. Sternberg had to make three trips to Pensacola before I arrived. I was delighted to be again in our home. The bay was tranquil and restful to look on and it seemed hard to believe that it was the means of transporting that terrible disease of yellow fever to so many innocent victims. "But always it came in a ship"; at least, it was the final conclusion of every board of investigation that it was traced to passengers from a recently arrived ship. Dr. Sternberg's report says: "after a careful consideration of the facts I have not been able to find any other source of infection as satisfactory to my mind, and that the disease

did not originate at Barrancas seems almost certain for the following reason: Yellow fever has prevailed at Barrancas but six times in fifty-four years. Its appearance in every instance has been preceded by the arrival in the harbor of a vessel from an infected port." Neither Dr. Sternberg nor I at that time had ever had yellow fever in spite of the fact that we were exposed to two earlier epidemics, and we remained at the post the entire time. It was lonely and sad because there were so few of us at the post. But professional work and writing absorbed my husband's entire time.

Dr. Sternberg's first publications of scientific value were prepared about this time, and related to the *modus operandi* of the yellow fever poison¹ and a study of the natural history of yellow fever.² These investigations served to eliminate at least some of the obscure factors, if not to discover the immediate cause of the disease, and gave him a position as an authority on yellow fever.

A PREHISTORIC MOUND

On my return from the North I found many changes. My close friends and associates in the Navy Yard had suffered much. Many had died, others had gone north to recuperate. The strenuous work and close confinement to his professional duties had been trying for Dr. Sternberg. Now that the strain was over, I thought to relieve the tension by driving into the country.

While in Warrington one morning, my husband met by chance the captain of a little sloop, who was telling a group of men some facts relating to an extensive "shell heap," quite near his home on the bay. Dr. Sternberg had always been interested in anything that would reveal facts relating to prehistoric man, and he therefore decided to make a trip to this interesting spot. The day fixed on was fine and the sail up the bay was delightful. On arriving the party found the shell heaps much larger and more extensive than had been expected. Their size and extent were considered proof that great numbers of Indians had at some remote period frequented this spot to enjoy oysters and seafood. There were evidences that

1. New Orleans M. & S. J. (N. S.) 3:1-23, 1875.

2. New Orleans M. & S. J. (N. S.) 4:638-674, 1877.

white people had visited the place before, as shown by several spots where attempts had been made to explore by digging. Dr. Sternberg instructed his party to be very careful in excavating in order not to break or lose anything left behind by the people who had made this wonderful shell heap. Some arrow points and some tools made from bone and conch shell were taken out. One particular tool made of fine thick conch shell created quite an interest. As Dr. Sternberg had seen a similar instrument of iron in use by the Indians on the plains for rubbing down and softening pelts, he felt convinced that this specimen had been designed for the same purpose. None of the material was of a very remote period nor did it differ much from things found elsewhere under like surroundings.

On another drive we learned from the country people of an Indian burial mound, though it was not until later that we gained information regarding its exact location. A day having been fixed for the expedition, the commanding officer assigned us a large wagon and team with two men. We took camp equipage, supplies, cooking outfit, with everything necessary for comfort and we drove in our light buggy. The road led through the pine forests, where the grass and the roots of the pine trees impeded our progress and obliged us to proceed quite slowly. We reached our camping place about 4 o'clock in the afternoon, made friends with the people who owned the mound, asked permission to camp and to explore, and engaged the owner to assist. This man was very hospitable and seemed really glad to see us, but we did not meet a woman although we could hear the voice of one in the rear room of a very old and small house. Our men soon had the tents up and the camp in order, and a little cabin nearby accommodated the iron bedsteads and our personal camping outfit. After supper we strolled about to inspect the mound which was not far from Perdido Bay at a place known as Bear Point. There were a number of trees on the mound overtopped by a very large live oak, which men of the locality estimated was at least 100 years old.

In the morning, Dr. Sternberg decided to cut a trench through the center of the mound. He superintended the work of two of the men while I watched the other. As soon as the digging utensil struck anything other than sand, the work

ceased and a careful lifting of the sand by Dr. Sternberg would bring to light whatever substance had been struck. We soon found fragments of pots, and a little deeper we unearthed numerous pots of all sizes and colors; these were so saturated with moisture that it required the greatest care and skill to remove them intact. A number of these were placed carefully in the wind and sun where they were soon dried and hardened. Our main interest centered on a nest of smaller pots. They were beautifully made and decorated, closely resembling specimens exhibited in museums as pottery from Peru. In one we found a beautiful blue bead, in another a perforated disk made from a shell about the size of a 25-cent piece. We unearthed a great number of stone disks of all sizes, suggesting no useful purpose other than some game, like quoits. One, in particular, we studied for some time and have since looked for its mate in museums, but without success. This disk, eleven inches in circumference, was evidently fashioned of beautiful chalcedony. It must have been traded from some Northern tribe, as no such stone ever existed in Florida. As it was highly polished, Dr. Sternberg thought that it might have been used in a national game. Another interesting little disk was made of lead, very skillfully inlaid, with a round centerpiece of copper. Detached parts of human skeletons were found; these were removed with the greatest care and were sent to the Army Medical Museum for study and comparison. There were innumerable pieces of clay figures, a fox's head, a squirrel's head (the latter had a little bit of clay within, as if it might have served as a child's rattle). There was a very good representation of a duck's head and bill. We also found quite by itself a small reproduction of a woman's head, with a slight suggestion of Egyptian, even to the cast of countenance. A long and faithful search for some article associated with this particular piece, proved unproductive.

Only two items of the collection helped to fix the date of this particular mound. In one of the small pots we found a blue bead; in another a large nail, badly eaten by rust. Dr. Sternberg was convinced that the Indians had acquired this nail after the Spaniards had discovered our continent, and that it probably came from timber of a wrecked vessel. We sent a fine collection of the large pots to a state museum, but

notwithstanding careful packing, many of them were broken in transit. Dr. Sternberg reported his findings before the American Association for the Advancement of Science at Salem, Mass., in 1879.

ATTACK OF YELLOW FEVER

In June, 1875, the ship *Von Moltke*, from Havana, arrived in Pensacola harbor with cases of yellow fever on board. She anchored opposite Fort Barrancas over night before going to the quarantine station (Pensacola) next morning, and no communication was permitted with the shore. We had a strict quarantine and the captain made affidavit that no one had left the ship. The result was perfectly successful as far as Pensacola and the Navy Yard were concerned. Three weeks later, however, yellow fever again made its appearance at Fort Barrancas, a number of cases occurring almost simultaneously in three different localities; in the company barracks, in the laundresses' quarters and in the officers' quarters. A severe epidemic appeared imminent. Dr. Sternberg had given me intimation of his anxiety, and said he would report conditions at once to the commanding officer and ask to have the troops sent to Fort Pickens, across the bay. The order was given and my husband returned home and said to me "My dear, I think you will have to go away from the post." I demurred on the plea that I had never left him alone and that he would need me then more than ever. He replied, "There are several reasons why you should go. I want the garrison to feel that my entire time is at their disposal, for undoubtedly we are to have an extensive epidemic."

While we were discussing the matter an order from the commanding officer requested Dr. Sternberg to advise in regard to a young lady who was visiting the officer's wife and would be quarantined. She was a Southern girl who had never been exposed to yellow fever, and was badly frightened. The commanding officer suggested that I take the young lady with me. My husband came home and said I must decide at once to go from the post. "You cannot go north, and I am not willing you should go far from me. If you are taken ill I will come to you; you are expected to take this young lady with you." Everything was quickly arranged; a government wagon was given us and a captain who had suffered from

yellow fever in Mexico was to take charge and get us located. I took our man and our pony, and in the wagon were tents, camp equipage and a month's supply of provisions. My husband said in his last farewell, "Don't put any water between us."

After we were well on the road, the officer went into every house to ask them to take us in, telling them we were leaving home on account of yellow fever. No one wanted us. We had gone ten miles and night was coming on, when a woman finally consented to take us in. "Come in," she said, "I have daughters of my own and I cannot send you away. We are poor at present; we have nothing to offer except the roof to shelter you." I thanked her cordially and told her we had supplies to subsist on for quite a while and I begged her to take charge of everything that we had brought with us. In less than twenty-four hours these people were quarantined by a guard from Pensacola, a small city twenty-five miles away. These men with guns paraded around the place and would not allow either the owner or his sons to go to town for supplies.

Before leaving Barrancas an arrangement was made for me to hear from home and when our stopping place was known a box was placed on a tree about half the distance from the fort. On the first two days my servant brought a letter from my husband. On the third day a guard challenged him; he had orders not to let the man from home have any communication with others, and on that day I received no letter. In his last letter my husband had told me that no professional help had yet reached him, and he was almost exhausted from the demands made on him. He said, "Don't worry if you do not get a letter in a day or two." This was reasonable, and I counted the hours until I would hear again. The fourth day my orderly brought a letter addressed in another's handwriting.

I knew intuitively that my husband was ill. The letter was from the commanding officer, and it confirmed my forebodings. The Surgeon-General had telegraphed from Washington to do everything that money and friends could to carry Dr. Sternberg through. A surgeon from Pensacola had taken charge of him, and two surgeons had arrived from New Orleans to attend to the other sick. But the main object in writing was

to tell me not to try to come home, as an order had been given that no sentry was to let me pass.

My poor husband was extremely ill from the beginning and his overtaxed condition made it a terrible struggle. He suffered from all the bad symptoms of a horrible disease. I knew he should be convalescing in eight days, but I received no encouraging news. Finally, I could stand the strain no longer. After three weeks of mental torture, I wrote to the commanding officer, "Please tell me the worst, it cannot be worse than the agony I am suffering at present. I know he should be convalescing, and if you do not tell me all I shall immediately come home." He wrote me a long letter telling me that my husband had almost every possible complication and was still suffering great pain from a septic infection; that he had been near death from exhaustion, but they were hopeful; he would pull through, I was to stay where I was.

Meanwhile the domestic life in our refuge home was not very satisfactory. The young lady who had joined me was anxious to get to Georgia. She confided to me one day that she "ran before Sherman in his march through Georgia, but her present situation was a great deal worse." A country quarantine is very annoying, and I was relieved for her sake when at the expiration of two weeks she arranged through influential friends to get away. My letters from home were now becoming more cheerful and the world seemed brighter.

After a month at this refuge a message came instructing me to go without delay to Pensacola, to take the train north the following night, that my husband was improving and would meet me as soon as he was able to travel. My pain at parting with these good people was quite sincere, for the dear little mother had comforted me in my troubles even as my own mother would have done. The road was rough and we could not travel fast but with twenty-five miles to make we did the best we could. A severe storm forced us to seek shelter in a logger's camp, and delayed progress for considerable time. After the rain abated, and we were again under way, we met a man on horseback. He drew rein and inquired "Is this Mrs. Sternberg?" I said, "Oh, please don't tell me any bad news." He said, "No. I have come from Mrs. Herron to meet you. (Dr. Herron had been taking special care of my husband dur-

ing his entire illness.) Mrs. Herron has seen the Mayor of Pensacola and you have permission to stop and take a cup of tea with her." My original instructions had been to proceed at once to the railroad station. It was quite dark when we arrived at the home of Mrs. Herron. The door flew open and a little lady whom I had never seen came quickly down the steps to meet me. She clasped me in her arms and said "My darling child, the news today is good from your husband and my son tells me he will recover and meet you in the North." My husband had sent money to Mrs. Herron and she had made all the arrangements for my comfort on the trip. The one thought that would not be banished was that I was leaving my dear one still fighting bravely and desperately for life, and I hoped and prayed he would be victorious.

My trip was long and lonely and I arrived in due time at my father's house worn and weary. Scarcely had I rested from my great strain, when I received a telegram from my husband to meet him in St. Louis at a fixed date. August 16, 1875, the surgeon at Barrancas had sent him in charge of a nurse to New Orleans and thence up the river to St. Louis.

CHAPTER FIVE

IN EUROPE

When we met in St. Louis my husband had so changed that I would not have known him had we met without appointment. He weighed less than 100 pounds and was badly discolored and disfigured. His suffering had been very great and I afterward learned that his life had been despaired of at many stages of his illness. After a rest of several weeks we went to Washington, where Dr. Sternberg reported to General Crane, Surgeon-General of the U. S. Army. General Crane was most cordial in his greeting, congratulating Dr. Sternberg on his recovery. "But," he said "you are in no condition to go on duty; take a leave of absence and go to Europe." This being agreeable to us, General Crane suggested we could go immediately to Southern France where the climate would be mild, and my husband could there recuperate more rapidly. Dr. Sternberg was granted a leave of absence for six months, November 9, 1875, and we went to New York a few days later to make our arrangements for sailing. We had no difficulty in securing a very comfortable stateroom on the S.S. *City of Chester*, Inman Line.

The trip over was pleasant in every way; there was no rough weather and we had very agreeable fellow passengers. On landing we went immediately to London, where we put up at a quiet little hotel near the Strand. Our time was spent in strolls on the Strand, admiring the shop windows, and in taking short drives. After a sufficient time spent in the city to enable us to forget entirely our recent sea voyage we proceeded to the Continent. A stormy crossing of the Channel made it advisable to take a rest in Paris, where a short sojourn so restored us that we were able to resume our original program to go to Nice.

In Nice we were fortunate in the selection of our hotel, the *Hotel des Anglais* on the *Promenade des Anglais*, near the center of social activity. On the morning following our arrival, we were delightfully surprised by a visit from a very dear friend. She was the wife of an officer of our Navy who had served at the Pensacola Navy Yard, where Dr. Sternberg had known the family quite intimately, and she now proposed

that we visit them at a large villa which they had taken. We appreciatively demurred on the ground that Dr. Sternberg would be more or less of an invalid for some time. "That is one more reason you should come to us," and she recalled to our memory that Dr. Sternberg had been very kind to them in severe illness. Her mother was with her and she would be delighted to see both of us. Someone called and nothing more was said. On returning the visit several days later, we were charmed with the atmosphere of their home. We found the villa delightful and my friend said, "If you can not make up your minds to come and visit us, come and mess with us. It will give us all much pleasure to be again together." This proposition was gladly accepted and the arrangement proved ideal. I accompanied my hostess to social functions, and Dr. Sternberg had charming surroundings, good care and agreeable company.

In the early hours of the afternoon, my husband and I often walked or drove on the *Promenade des Anglais*, where was to be seen a fine moving panorama. The great expanse of beautiful water on one side of the drive added a distinctive charm to the picture. One could meet visitors from all nations, some driving or riding, others walking. We were early cautioned to be at home by 4 o'clock in the afternoon, as the air then reminds one that the snow of the Alps is not far away. Later during our stay, when Dr. Sternberg's health improved, we drove to many interesting places in the immediate vicinity, even going with others to Monte Carlo to attend a concert in the great music hall.

On Christmas Eve at Nice, Dr. Sternberg received notice that he had been promoted to the grade of Surgeon with the rank of Major. While this was cheering news it awoke anew the recollection of an act of injustice to three medical officers who should have received this promotion as early as February, 1869. The history of this is best told by extracts from a report of the Committee on Military Affairs, dated February 8, 1875, to whom was referred the petition of Charles B. White, George M. Sternberg and Joseph Janvier Woodward, Assistant Surgeons, U. S. Army, asking redress for grievances. The committee on the bill (H.R. 3858) to authorize the promotion reported:

That on inquiry at the War Department they find the facts with regard to the record of these officers to be substantially as stated in their petition. It appears that three vacancies in the grade of Surgeon in the Medical Department of the Army originated on the 22nd of February, 1869; that these officers, all of whom are of unblemished record, were at the time entitled to be promoted to these vacancies under the laws and regulations then in existence, and that they actually were on the same day, viz., February 22, 1869, nominated by the President to the Senate for said promotion.—The Senate however failed to take immediate action on the nominations, and while they were pending the Army Appropriation Bill approved March 3, 1869, became a law, the sixth section of which prohibited further appointments and promotions in the several staff-corps, among them the Medical Corps, until further legislation.

This Bill appears to have been construed as forbidding the promotion of these officers although they had been nominated prior to its passage, for no further action was taken in their case at that time.

Two years later, and near the close of a session of Congress, viz., February 14, 1871, the President again nominated these officers for the same promotion, and the session having expired without any action being taken upon the nomination, he for the third time submitted them to the Senate (in extra session) March 6, 1871. It appears from a note appended by the President to these nominations of February 14 and March 6, 1871, which note is a matter of record in the War Department, and an official copy of which is herewith annexed (marked "C") that the President in nominating these officers for promotion the second and third time, took the ground that, as they had become entitled thereto prior to the act of March 3, 1869, prohibiting further appointments and promotions in the staff corps, that act ought not to bar their promotion and he says; "I deem it an act of justice to the officers that these promotions should be made from the dates they became entitled thereto."—The Senate nevertheless took, it appears, no action on the nominations. . . . In view of all the foregoing facts we recommend the passage of the bill (H.R. 3858) to authorize the promotion of these officers.

Notwithstanding this favorable report the bill failed to pass and Dr. Sternberg, with his two colleagues, was deprived of the promotion to which he was justly entitled from February 22, 1869, to December 1, 1875. He lost the difference of pay between the grade of Captain and of Major; not a very pleas-

ant contemplation for a man who was just recovering from an attack of yellow fever contracted in line of duty.

Dr. Sternberg grew anxious to go to Italy and as he was not yet very strong we decided to travel slowly. Our first stop was to be Genoa, which at that date was the chief commercial city in Italy. The railroads from Nice skirt the coast and the numerous promontories are penetrated by tunnels, some of them so long that they must have been serious problems for the engineers. We remained in Genoa only long enough for Dr. Sternberg to recover from the fatigue of the railroad journey, spending our days in drives and in visits to points of artistic interest. Our visits to all the large cities in Italy were keenly enjoyed although we would have liked more time for appreciation of natural beauties. At first we exercised great care in regard to the time we should give to visiting picture galleries for fear of taxing Dr. Sternberg's strength. But by living much in the open and in the sunlight, he gained strength daily, and we could safely spend many happy hours in the galleries. With the assistance of experienced friends, we were able to enjoy profitably every moment of our stay in Florence, Venice, Naples and Rome. We spent more time in the last city than in any other, for reasons that are obvious. Our return was by way of Paris and London.

Having turned our faces homeward it is not surprising that we became anxious to be again on our native soil. Despite pleasant recollections of London we were obliged to hasten to Liverpool to take the steamer for New York. We returned in the same steamer on which we had made the trip East; she seemed like an old acquaintance when we boarded and there were many familiar faces. Our return passage was stormy and exciting. After we had weathered the storm and all were feeling almost cheerful again, the engines suddenly stopped. The steamer rolled terribly, as will any vessel in a heavy sea without steam power to resist. The waves broke upon our deck and washed over with a distressing noise, while passengers grew pale, nervous and ill. Everybody was curious and anxious, but no one seemed to know the cause of the hammering and pounding and delay. When finally the ship was struggling again to be under way, we were rejoiced and our spirits quickly revived.

CHAPTER SIX

IN THE DEPARTMENT OF COLUMBIA

Relatives met us in New York on our arrival the latter part of April, 1876, and as soon as our baggage was procured we were on our way to Washington. My husband reported for duty to General Crane, and was given a choice of station in the Department of the Dakotas or the Department of Columbia. We talked the matter over and decided we preferred the latter. The order came May 1, 1876 for Dr. Sternberg to report for duty at Headquarters of the Department of Columbia, Portland, Oregon.

Crossing the continent by rail at that time was not exactly a great pleasure trip. We were eight days and nights on the road, the alkaline dust in the arid region penetrated every crevice until the atmosphere in the car was at times almost stifling. There were no dining cars, the train stopped at intervals at public dining rooms close by the station. The food was greasy, coarse, and badly cooked. The only pleasant memory of this trip is the sight of a large herd of buffalo, of which at that period herds of considerable size roamed the plains, in quest of better grazing lands in the north. Our route was by way of San Francisco, where we took ship for Oregon. The San Francisco we saw at that time has been replaced more than once since; the old frame houses and the wooden pavements have several times given place to more permanent and yet more substantial improvements.

As we steamed out of the great harbor of San Francisco, we were deeply impressed with the natural charms of the Bay. There are three beautiful islands, on each of which our Government had established military defenses and institutions of national importance. The wide expanse of water, the majesty of distant mountains, and the soft haze of floating clouds upon a background of green and golden hills of the distant landscape form an inspiring picture. The ship was old, the sea was rough and many of the passengers were soon suffering from the motion of the waves. We plunged along, our thoughts concentrated on the greatest interest to all on board, that of reaching the mouth of the Columbia River. The recital

of the grandeur and beauty of that stream had been glowingly painted by some of our fellow passengers, and we approached the mouth of this river on the morning of the fifth day.

Before improvements were made by the government there were three channels across the Columbia bar, varying from nineteen to twenty-one feet in depth, unstable and uncertain in regard to position. The passengers who knew the bar related the history of the ships that had been lost and pointed out the very spots to make their recital more realistic. Theodore Winthrop's description of the bar is a vivid representation of what we found: a wall of terrible breakers marking the mouth of the Columbia—Achilles of rivers. When the word was finally passed along that the ship was over the bar, we took interest in the river and the adjoining scenery. The first landing was at Astoria, 110 miles from Portland, where the Astors had established a large fur trading store. In 1876, the year of our arrival, the great industry of this section was fishing and canning of salmon. Gazing across the Bay from enterprising Astoria, we had a view of an Army station known as Fort Canby; Cape Disappointment and Fort Stevens, places of military importance, are also nearby. Further up the river, there are magnificent scenes, such as perpendicular basaltic bluffs, side hill farms and fishing scenes. Suddenly, Mount St. Helen's appears—the "Queen of the Cascades," her summit draped with a robe of pure white snow. On a clear day with favorable atmospheric conditions one may enjoy a wonderful sight from the junction of the Willamette and Columbia Rivers, quite near Portland. In the distance, four snow capped peaks are seen, Mount St. Helen's, Mount Jefferson, Mount Hood and Mount Rainier.

PORTLAND, OREGON

We early learned that Dr. Sternberg was to act as medical director of the Department of the Columbia during the absence of the incumbent, and this duty kept us in Portland from June 9, to September 1, 1876. Through the advice of friends we arranged for lodgings with a charming hostess and we enjoyed life in her home as if in our own. The residence was situated on quite an elevation and my windows looked on a magnificent view. Immediately in front of us, no great distance away, Mount Hood towered high, 11,225 feet above sea level. Shortly

after our arrival in Portland there occurred an alarming flood, which covered to an uncomfortable depth all the city situated on the lower level. This was phenomenal and the result of an abnormal amount of water from the melting snow. The splendor of the rose gardens in Portland cannot be exaggerated; nowhere have I seen more luxuriant and gorgeous blooms. The beauty of young women finds here an appropriate setting and I can add my testimony to that of others that nowhere in America does one see complexions to rival those of the girls in and about Portland. The equable damp climate, no doubt, leaves its mark in beautiful color on the rose and on the cheeks of the young women.

FORT WALLA WALLA

On the return of the medical director, Dr. Sternberg was relieved from this duty. His official and professional work had proved very interesting for he had been often solicited to serve as consulting physician in obscure and serious cases of illness by resident physicians. The medical director gave him a choice of a new station, naming Fort Vancouver in Oregon, or Fort Walla Walla in Washington. He chose the latter, because of climatic preference and of prospects for remaining longer without change.

Immediately on our arrival at Walla Walla in August, 1876, Dr. Sternberg reported for duty and asked to be authorized to remain for a time at the hotel. The pretty little town is situated in a wide valley in an ideal setting. The early settlers had planted rows of French poplars, so frequently seen bordering European country roads. Here, they bordered the irrigation ditches. When our furniture arrived we took quarters at the garrison, secured a Chinese cook and were soon established in our new home. The house was heated by large open fireplaces, which gave comfort and greeted with cheer all who entered.

The post hospital was some distance from the house, in a wooden building of ample size, but of primitive construction. Every morning at 8 o'clock the bugler blew "sick call" and the post surgeon proceeded to the hospital to examine and treat the men who had been reported sick. Shortly after our arrival we purchased from an officer, who had received orders to repair to another station, a blooded bay mare and a light buggy.

These afforded the means for many interesting drives in the valley and over the surrounding mountains. We remained three years at Walla Walla and each year the great wheat fields extended higher and higher up the foot hills. In the early morning hours the mountains presented a charming view; a soft white cloud of moisture floated like a billowy scarf of tulle half way up the hills, which were draped by the dark green of pines above and the fields of light green below; over all spread a clear blue sky.

In the course of attending to his consulting practice in the town, Dr. Sternberg made the acquaintance of a lady who contributed much to our intellectual progress and pleasure. During professional visits to her son, Dr. Sternberg noted that she had an excellent library, and that she was a woman of education. It developed later that she had been educated as a teacher in France (her native land), and was at that time teaching her own children Greek, Latin, German and French. Later Dr. Sternberg suggested it would help to pass my time profitably and pleasantly if I should have lessons in French from her. At my request, Dr. Sternberg consented to join me in the lessons and we found the lady an ideal teacher. She never wearied in training us to master the nasal accent, and in the three years of our studies covered a wide range of French literature. Dr. Sternberg mastered every difficulty of the language, and could later deliver lectures in French. When in Europe, he was complimented on his excellent accent.

FOSSIL REMAINS

Intercourse with civilians in the town led to friendship with a civil engineer who possessed a liberal education and a fondness for scientific discussion. Dr. Sternberg spoke to him of the wonderful fossils he had discovered in the chalk beds in Western Kansas during his year in the field with General Sheridan after the Cheyennes. This caused the civil engineer to produce some interesting specimens and to give details in regard to a section of the Northwest which he had surveyed. Dr. Sternberg became much interested and most anxious to explore this field.

The commanding officer interposed no objection to his going with the next lot of recruits to Fort Colville. Arrangements

were made with a physician in the town to attend to the post duties, the quartermaster loaned us tents, a wagon, horses, men, in fact everything was done to make us comfortable on the trip. The first day's march was not long, and proved a glorious experience. We camped near a little brook. Fires were soon lighted and supper under way, some of the men pitched tents, ours a large one with iron beds and two chairs. After supper, some fished for trout in the little stream, while we went for a short walk and to watch the afterglow of a beautiful sunset.

Very early in the morning the bugle aroused us and we were soon on the way, ending our march by three in the afternoon. All looked forward to the night we were to camp on the banks of the Snake River, one of the important tributaries of the Columbia River. No sooner had we begun to make our camp here than a white man and two boys came to learn where we were going. The man proved to be the owner of the ferry, he remained but a short time and volunteered to assist us in any way he could. The boys came again and brought me some arrow heads, with a message from their mother, who would be pleased to come and see me if I desired. I walked home with the boys to invite her to visit me at the camp. Their home, a little wooden house, was situated high on the banks of the river, for this river at times has a tremendous overflow and is always a deep swift stream. There was an air of peace and happiness about the house, with flower boxes on the porch, and other evidences of a woman's hand and influence. She was from New England and had been living in this lonely spot for a number of years, with infrequent opportunity of seeing a white lady. When the boys told her there was a little blonde lady in the camp, she thought this woman might possibly be from the East and she wanted to meet me.

Soon after our arrival we were made aware of the presence of a band of Indians on the opposite bluff of the river: the beating of the "tomtoms" made a great and almost constant noise to which the shouting of the men added a touch of savage ceremony. We could distinguish numbers of them from time to time plunging into the river and swimming about. As soon as our tents were up and our lighted fires were sending up a smoke, boats put out for our shore. They pulled so swiftly

that the boats literally shot through the water, and soon landed near our camp. Majestically the chief and his interpreter came up to the bank of the river to interview the "Medicine Man." (They had learned through the soldiers that Dr. Sternberg was in charge of our expedition and that he was a physician.) The chief did not seem pleased to see us and questioned closely through his interpreter in regard to the number of recruits and where they were going, also what our own destination was. He talked for a long time; finally he told us he had a sick daughter that had been coughing for "two snows," and asked for medicine to relieve her. Dr. Sternberg knew from past experience that tuberculosis is the greatest foe of the modern Indian. Having medicine with us, he prepared a cough mixture and gave it to the chief. Then the chief informed us he had no coffee, this was given him; no sugar, again his want was supplied. When all his requests had been complied with, he sat silent for some time before taking his departure. Quite early the following morning we broke camp, parting company with the large number of soldiers who were going north from this river crossing; four or five enlisted men remained with us.

The ferry was known as a "current ferry." The big boat was taken over by cables and the whole movement was controlled by the current of the river. The Snake River is very deep and swift, and I noticed that the men were more or less excited over making a successful crossing. But all went well. We landed and drove slowly up a steep roadway leading to the level, and turned the horses' heads down the "Coulée" on our way to Washtuckna Lake, the fossil field. We were to camp for the night on the banks of a large lake, and to proceed to the fossil regions early the next morning. This lake proved an extensive sheet of water, and we could see wild geese and ducks flying in great numbers over our heads. As soon as the tents were pitched, the fires built, and the mules and horses picketed, the sportsmen were off for the lake. From patches of bushes which were used as blinds, shots reverberated every few minutes; from their number I felt sure we would never be able to take the game home with us. Only approaching darkness brought the party back; they had captured no ducks or geese, because they had not been instructed how to fire, and had fired

into the breast of the bird instead of waiting until the bird was flying away.

While the soldiers were sitting by the camp fire later in the evening, a lone horseman rode up and asked to be permitted to camp near. He told the men the northern Indians were roaming in small bands everywhere, and some of them were very ugly and insulting, and as he was a lone herdsman with a lot of cattle he feared to be on the hills alone at night. Sentries were ordered to keep a very close watch over the mules and horses that night for fear that they might be stampeded by the Indians, and we be left at their mercy without transportation. All night the coyotes howled and barked constantly just outside the tent. It was not necessary to call anyone in the morning for none of us had slept very much. After a hot breakfast we were soon off for the fossil field, some 11 miles distant over hills, and arrived about noon on the brink of the lake basin. As it was not very safe to be so far from civilization when the Indians were excited and roaming about, Dr. Sternberg hastened the exploration in as thorough and satisfactory a manner as possible. No explorer had previously been on the field, except the civil engineer who had hastily surveyed it.

We found large numbers of clean specimens, representing the horse, the elephant, the camel, the elk and the deer. I had the good fortune to find some large teeth, collecting so many that my basket would not hold them. What changes in nature must have taken place since these animals were natives of this zone, doubtless coming to this lake to drink. The wind had whipped the sand away and the fossils had dropped lower and lower, maintaining the same relative positions occupied in life. We carried away with us a great quantity of interesting relics. In time Dr. Sternberg sent specimens to Professor Cope of Philadelphia and other scientists for description and classification. I still have in our cabinet some of the most beautiful and perfect.

It had been promised that on our return trip we would visit the beautiful Shoshone Falls, a little higher up on the Snake River. We were near enough at one time to hear the roar of the cataract, but Dr. Sternberg thought that the information in regard to the Indians made it unsafe to go on a pleasure jaunt.

CHAPTER SEVEN

THE NEZ PERCÉS CAMPAIGN

There was intense anxiety at that time because of unrest among the Indians. Several tribes were roaming over the country, the Nez Percés among them. As much will be said about these Indians, a few words about their past history may not seem amiss. It is related that the pioneers pushing West after reaching what is today known as the Kamiah Valley, found a large body of Indians; these subsequently became known as the Nez Percés. They appeared to be honest, intelligent and attractive, eager to assist the whites, kind and helpful, although shrewd and businesslike in their trading. The pioneers left their horses with the Nez Percés and took canoes down the river, asking the Indians to meet them at the same point on their return the following spring. With scrupulous fidelity the Nez Percés carried out their agreement; an evidence of the oft repeated assertion that treachery was acquired by the Indian from association with the whites.

From a bulletin of the Bureau of American Ethnology the following is learned of the Nez Percés in 1805. They occupied a large area in what is now western Idaho, northeastern Oregon and southeastern Washington on the lower Snake River and its tributaries. They roamed between the Blue Mountains in Oregon and the Bitter Root Mountains in Idaho. The Nez Percés held the Salmon River country in Idaho in 1834 and probably also the Grande Ronde Valley in eastern Oregon. A large part of this territory was ceded to the United States by treaty in 1855, at which time they were confined to a reservation including the Wallowa Valley in Idaho. With the discovery of gold and the subsequent influx of miners and other settlers, the Oregon land districts were in demand, and a new treaty was made confining the tribe to the reservation at Lapwai, Idaho. The Indian occupants of the Wallowa Valley refused to recognize this treaty, and under their chief, Joseph, took active measures of resistance.

Though at first Joseph's band of Nez Percés opposed the treaty, they finally acquiesced in what they understood contained the stipulation that they should possess the Wallowa

country as their permanent home. The Joseph of that time was later succeeded by his son whose Indian name was "Halla Kalla Keen," or "Eagle's Wing." Writers of that day say he was the finest specimen of Redman ever seen in the Columbia Valley. Magnificent in stature and proportions, his rare dignity and nobility of bearing and qualities of mind and heart made him a remarkable chief. Joseph loved the Wallowa Valley with the affection of a youth whose associations had been connected therewith, and at first made every effort to maintain the good will of his white neighbors, but when the Government violated what he regarded its sacred pledge, and permitted entrance on his lands, he refused to abide by the decision and led out his warriors to battle.

General Howard,¹ in his account of the beginning of this war, states that the Department of the Interior at Washington issued its instructions to carry out the recommendations of the November commission to its agent at Lapwai early in January, 1877. Orders were sent to him to occupy the Wallowa Valley, as had already been done for three years and to cooperate with and aid the Indian agent. Learning General Howard was at Umatilla, Joseph sent word that he wished to meet him for a conference at Walla Walla. The request was granted; Joseph did not come, but sent his brother Ollicut (Young Joseph) to represent him. Ollicut put in an appearance at Walla Walla about 6 p. m. April 19, 1877; with him were several other prominent Indians, among them an old medicine man. The Indians came into the Fort by the west gate and Ollicut apologized for the absence of Joseph because of illness. The next day was fixed on for the conference and the Indians sought a place to camp for the night.

The council opened at 10 a. m. in the band practice room. The Indians sat on benches on one side of a large table, officers and a few ladies on chairs, and some citizens on benches. I was greatly impressed with Ollicut. He was over 6 feet tall, well formed, with small shapely hands and feet. He brought with him a map which he had drawn, a talent for which he was reputed; it was made in color on the fleshy side of a cow skin. He spoke in pathetic manner of the white man's injustice, and

1. I am indebted to General Howard's report for many of the details here presented.

of the misunderstanding of his tribe, and made an effort to explain the impossibility of giving up the Wallowa Valley for the Lapwai reservation. He pointed to his map to show the difference in area and fertility of the lands proposed as exchange; explaining that his tribe's industry was raising horses, that the Lapwai reservation would not be large enough to support them in addition to those already there. But he could see that he was not convincing his hearers, and some of the others not so diplomatic grew loud and boisterous. The ladies had to leave the court room and were not permitted to be present the next day.

However, the Indians left Walla Walla with the understanding that General Howard would meet them in council at a later date at Fort Lapwai, Idaho. This council took place at the appointed place in May, 1877, Joseph and his brother with about fifty of the tribe being present. The sessions were held in a large hospital tent. All picturesque features of the paint, dress and trappings of the Indians were strictly carried into effect. A Catholic priest from the reservation opened the meeting with prayer. General Howard referred to the council with Ollicut at Fort Walla Walla twelve days before and quietly stated that he was there to learn what Joseph had to say. Joseph said that there was another band of Indians, under Chief "White Bird," from the Salmon River Valley and he should be there the following day, and he requested that they should not hurry away until all were there for the talk. He was then told by General Howard that Mr. Monteith (the Indian agent) and he had received instructions from Washington. "They sent us to your people and should you comply with the wishes of the Government you can have the first pick of vacant land. We will wait for White Bird if you desire it." The "dreamer" and the "medicine man" then spoke in petulant and querulous manner. The agent read his instructions from Washington, which were carefully interpreted, and he added, "I sent out Reuben (then the chief of the treaty Nez Percés) and some others to your camp, and invited you to come in. (This message went to them in the Grande Ronde Valley, or Wallowa country, and was not heeded.) Joseph can select the place he wants if he will do so at once." Ollicut, a splendid, intelligent fellow seemed at times almost persuaded to yield to

the white man's power, then driving himself in seeming regret to the opposite extreme, Ollicut spoke. "We must think for ourselves, white men and Indians, we have respect for the white men but they treat us like dogs and I sometimes think my friends are different from what I supposed. There should be one law for all. If I commit murder I shall be hanged, but if I do well I should not be punished. Our friends will be here tomorrow and I will then tell you what I think." Explanations were made at length by General Howard and Mr. Monteith, the agent. The old dreamer, whom the Indians regarded with great respect, became insolent and seemed to exercise a bad influence all the time.

The second Indian council was held at Lapwai, May 4. White Bird had marched into the Valley with part of his band. The remainder were driving ponies and fetching the lodges and provisions across Craig Mountain. After the formal opening of the meeting Joseph in a brief speech introduced White Bird. Joseph had made a careful toilet and rouged slightly, while White Bird's face bore an expression of impassability. The Indians put forward "Too-hul-hul-Sota," broad-shouldered, deep-chested, 5 feet tall, with a voice that betrayed in every word his settled hatred of all white men. He spoke for some time in seeming understanding of the situation. After a long and heated argument he proposed to Joseph and White Bird not to meet again until the following Monday.

It had become apparent that it was necessary to have more troops; a company from Grande Ronde Valley and a new company from Walla Walla were in this vicinity. The wild Indians were well armed, with many breech-loading rifles and pistols, while the friendly Nez Percés had nothing but shot guns. The non-treaty Indians had the best skirmishers in the world. Already there was hovering about Lapwai this well appointed force of Indians, and there was a nervous strain on the insufficient garrison.

The next council was a very exciting one. "Too-hul-hul Sota" was extremely insulting, eliciting a sharp reprimand from General Howard. Turning to the others General Howard asked Joseph, White Bird, and Looking Glass, to go with him and inspect lands. After another turbulent scene "Too-hul-hul-Sota" was expelled from the room and placed under guard, and

the other Indians changed their tone. They spoke pleasantly and agreed to go with General Howard to examine the Lapwai and afterwards the Clearwater country. On the return of this party the Indians came together for a final interview, Tuesday, May 14. Meanwhile, Captain Trimble's company of the First Cavalry had arrived at Lapwai and gone into camp. Special news brought the glad tidings that two other companies had reached the banks of the Grande Ronde, a fact which created much excitement among the Indians. Joseph tried in breathless haste to settle all matters speedily. The white inhabitants of Salmon River and Camas Prairie and the vicinity of Wallowa, and of the neighborhood of Tush-hush-cute's roaming places, had from time to time sent the agents complaints and earnest entreaties that the Indians be made to go on their reservations; quite a number of their representatives were present to urge the action. All came together for this final talk; the Indians' petition to release the old dreamer had been granted, and they entered into formal agreement with the agent and the Army, to be placed on the Lapwai reservation in one month (by June 14). Joseph had at last concluded that he would rather go to the Clearwater with the others, and this favor was granted him to relieve some embarrassing situations. There was general rejoicing over the peaceful outcome of the council.

On the fifteenth a detachment sent out from Lapwai met two excited Indians somewhere near Craig Mountain and turned back to Lapwai with them. The name of one was "Pu-tou-chloo," while the other was a boy about 14 years of age. The officers heard their story through an interpreter, to the effect that some three or four Indians had committed a murder near Slate Creek where there was a scattered settlement some 40 miles beyond Mount Idaho. It was in some way connected with a citizen named Larry Ott, who had killed an Indian. (I have always heard this murder occurred over the killing of a hog by the Indian. The bringing in of the hogs by settlers had been strongly objected to by the Indians, since the hogs destroyed the camass root, a small bulb largely used by the Indians to make their bread.) The ranking officer took the Indians to the reservation and there learned through the official interpreter that Larry Ott's story was confirmed by Mr. Whit-

man and all now believed that serious trouble was coming. The interpreter and the Indian agent thought it wise to send at once the acting head chief, Joseph's father-in-law, who still insisted that Joseph would not fight, and he volunteered to go. The party rode away at full speed. They had not been gone long when they came back with another communication from Mount Idaho, brought in by the brother of "Looking Glass" and a half-breed citizen by the name of West.

The time of busy preparation had come as before a battle, officers and men were mostly silent but in constant motion. Arms, ammunition, provisions, means of transportation, in fact, everything was being put in readiness, with steady nerves, without haste, without confusion.

We were well posted at Fort Walla Walla in regard to the military situation, by the constant arrival of couriers from the front. In the course of other business with the office of the medical director of the Department, Dr. Sternberg had been informed he would not be ordered in the field, but he might possibly be ordered to serve at headquarters in Portland to relieve a surgeon on duty there who wished to go with the troops in the field. Meanwhile we assisted in every way possible our friends who were going from the garrison. They left by detachments, as the situation grew more and more threatening. When our last troops marched away for the front, June 19, 1877, we drove a little way with them, thinking there would be messages to wives and children, or perhaps some personal business that remained to be looked after on account of the haste with which the men had obeyed the order to march.

It was nearly 11 a. m. when we returned home, and to our surprise we found an order for Dr. Sternberg to take his field equipment and proceed without delay to Fort Lapwai. He was to join at Wallula on the Columbia River the detachment of troops being rushed to the field for action from San Francisco and the artillery that had been intercepted en route from Alaska. We had but a few moments together after the order came; at 2 p. m. he took the train for Wallula, shipping his fine horse and his camp outfit by the same train.

Among the officers he joined on the river boat at Wallula were some he had known before. As he had been in closer touch with the war news than they, much of the time en route

to Lewiston was spent in reviewing the military situation. Immediately on the arrival at Lewiston they were met by officers from Fort Lapwai, and instructions were given to make all possible haste, to disembark and get under way to report at Fort Lapwai. At this post they were given extra supplies and some pack mules, and more explicit orders. In view of the information they received in regard to the situation at the front it was scarcely necessary to give instructions for haste and caution in advancing. They had learned of the terrible tragedy at White Bird Canyon, where Colonel Perry's command had suffered severe losses, and nothing more was needed to stimulate officers and men to do their utmost and move as fast as possible to the assistance of comrades and settlers, badly in need of help.

The men trudged quickly along through a cold rain and the officers did what they could to keep up the courage of the rank and file. They passed the spots already made known to the public by the assaults on the settlers by the non-treaty Indians. They marched past the White Bird Canyon where the bodies of their dead fellows were lying still unburied. No cheerful thought greeted them on their way. They were chilled through, hungry and tired, many of them almost exhausted, but they pushed doggedly on. At last they reached the designated camping place and rendezvous with comrades more than glad to welcome them. Dr. Sternberg, whose personal comfort was looked after by Captain Trimble of the First Cavalry, a member of Fort Walla Walla garrison, was very much exhausted from fatigue and exposure. It was quite dark when they arrived and the latter part of the trail had been very rough. The mounted officers found in crossing some of the bluffs that it was almost impossible to keep in their saddles. The horses would lose their footing and it would seem certain they could not recover a foothold. Later on these conditions were intensified and riding was accompanied with great discomfort, while walking was equally tiresome. Particularly was this true in the vicinity of the Salmon and Clearwater rivers. Often in quiet moments at home Dr. Sternberg would tell of the great fatigue and hardships of this campaign, that nothing helped the courage, and comfort, of every one as did the hot coffee and the crisp bacon and bread.

BATTLE ON THE CLEARWATER.

The following description of the battle on the Clearwater, July 11, 1877, I have abstracted from General Howard. After much skirmishing and taking of important positions to be protected beyond the second bluff we found Joseph and his people dismounted and already in position on our approach, while some thirty or forty mounted Indians had galloped just beyond our range to compass our left. Our troops all pushed forward in an open line of $2\frac{1}{2}$ miles in extent. The Indians by their rapid movements struck the rear of a small pack train, killed two packers and came very near capturing the ammunition. The main supply train was saved only by the quick work of a messenger guarding it within our lines, and at one moment it was feared the Indians would destroy all the food and the powder. The enemy manifested extraordinary quickness and boldness, planting sharpshooters at all available points, making charges on foot and on horseback, but these attempts were all resisted successfully. A spirited charge was tried on our right down into a ravine. At night the Indians had hastily thrown up barricades of stone behind which they fought. A move on our part was made on the right, using artillery, infantry, and every available man from the cavalry, including horse holders, orderlies, and extra men.

A few Indian sharpshooters managed to annoy every man who approached the spring, their only water supply, and in spite of a successful charge the situation was still uncomfortable. At this stage of the fighting Dr. Sternberg was called at night to go to the fighting line to take care of some wounded. He went hastily to the front and found a man who was a packer, badly wounded and bleeding profusely. He feared he could not remove him any distance without danger of great loss of blood. He instructed his assistant to light a candle and screen it with a blanket, in order to form a shield behind which he could tie the artery. No sooner had the candle been lighted than the bullets came thick and fast at this faint little mark, and it had to be quickly extinguished. No change in the situation, no matter how small, escaped the keen-eyed Indians. While at work among the fighting men Dr. Sternberg's attention was attracted by the calling of many voices saying "for God's sake bring us water to drink." Dr. Sternberg could not for one

moment resist the call for water and after placing his wounded under shelter he went to the officer's tent and succeeded in getting quite a force together to take water from the spring to the poor suffering men in the barricade. At one time they had to use water through which the mules had been driven in taking their position. The squaws were very helpful to the Indians by looking after the water supplies, and driving herds of ponies through the camp to cause our horses and mules to stampede, hoping thereby to leave the command without transportation.

During the first night of the Clearwater Battle, stone barricades were constructed by ourselves and also by the Indians. At daylight, July 12, every available man was on the fighting line. The order was given that food should be cooked and carried to the front, not an easy task, for the army had not yet secured complete possession of the spring, and sufficient water had not been procured during the night. The number of Indian warriors under Joseph were about equal to ours. All tactics that promised success were used by both parties; some of these were very difficult of execution. Even that maneuver known as "rolling up the enemy's line" was employed but Joseph made a stubborn resistance at his barricades and fought the white men with wonderful skill and bravery.

It is recorded, however, that at this moment in the conflict the whole line of Indians suddenly gave way. Immediately, pursuit was taken up by the whole force of infantry and artillery. Winters' troop was dismounted and the remaining cavalry followed as soon as they could saddle and mount. The Indians were completely routed, flying over rugged banks, through ravines, swimming and wading the rivers, with our forces in close pursuit. The Indian camp was abandoned in such haste that the lodges were still standing, filled with their effects, blankets, buffalo robes and provisions. Packers who knew the Indian customs went over the ground and found many "caches," where the Indians had buried their greatest treasures, in expectation of return. From these caches beautiful beaded ceremonial robes, belts, rugs and trinkets were taken out and sold to the officers. They were well covered with sod and so smoothly buried that no one not accustomed to this habit would have dreamed of locating them.

TRANSPORT OF WOUNDED

July 12, Dr. Sternberg was left at Kamiah on the Clearwater in charge of twenty-seven severely wounded, with verbal instructions to convey them to Grangeville, 25 miles distant. There was very little transportation or assistance to get the wounded back to civilization. Captain Winters was in command of the escort with a few wagons, some horses and mules (all inferior animals); the good horses and mules were taken to pursue the fleeing Indians. The transportation was too limited to afford comfortable travel over the rough mountain roads to Grangeville and then to Fort Lapwai. Dr. Sternberg had used the "travois" in the Indian Territory in a war against the Cheyenne Indians, and on seeing the lodge poles left by the Indians he evolved a plan for transporting his wounded soldiers on the travois. Very little time was required before all was in readiness for starting on the trip to Grangeville, where they arrived at 2 a. m., July 14.

From Captain Winters, the commander of the escort, I afterwards learned the details. At times when the horses and mules were halted and the wounded supplied with water, food and stimulants, Dr. Sternberg would inquire of the wounded men on travois if they wished to make a change with the men in the wagons. No one expressed such a desire. The travois proved much more comfortable, the long flexible poles dragging along slowly mounted over the rocks and ridges, without the jolt that accompanies even the motion of a wagon with springs. The experiences of the night were quite harassing. Joseph had been very shrewd in all of his movements, and the men felt almost certain that he would elude his pursuers and return. Dr. Sternberg, much exhausted from his work and the great strain and loss of sleep, found it difficult to keep awake as he rode alone during those long dark hours. Captain Winters was fearful he would fall asleep and get hurt by his horse. He therefore instructed his orderly to ride beside Dr. Sternberg and guide the horse and his conversation seemed to thoroughly awaken him. He then told Captain Winters he would ride ahead of the train, arouse the village, and get the people ready to receive the wounded, that perhaps he would be able to get a few winks of sleep and rest before the wounded arrived. Captain Winters agreed.

The inhabitants of Grangeville responded quickly, and very soon all the women were making arrangements to have hot coffee, sandwiches, bread and butter for the wounded and escort. Dr. Sternberg had taken possession of a large building used as a meeting place and carpenter's shop for the reception of the wounded. After the wounded were refreshed and their wounds dressed, they were made generally more comfortable. The people of the village were as nervous as they could well be over the thought that Joseph and his band might appear at any moment. Few of the settlers thought he would ever leave the Wallowa Valley which he loved so passionately, and all seemed to have the same impression that he would elude General Howard. This made Dr. Sternberg exceedingly anxious to get his wounded safely into Lapwai, where a well equipped hospital awaited them.

A condensed statement of Dr. Sternberg's report to the Surgeon General gives the details of the subsequent movements. July 19, Dr. Sternberg received permission to transfer the wounded from Grangeville to Fort Lapwai; he left Grangeville at 4 p. m., marched 18 miles and went into camp, arriving there at 9 p. m. They started at 5 a. m. July 20, marched 18 miles to Mason's deserted ranch, arriving there at 12 m., and halting for rest, dinner and to dress the wounds. They started again at 4 p. m and marched 18 miles to White's deserted ranch, camped there for the night, to start once more at 6 a. m. July 21, reaching Fort Lapwai at 9 a. m. Two of the wounded died on the journey from the battlefield to Grangeville and in another case Dr. Sternberg was obliged to amputate at the knee joint on his trip from Grangeville to Lapwai.

I had not received any news from my husband for ten days, I did not know where he was or to what command he had been attached, whether he had fared ill or well, and I had no word of him through other officers of the garrison. Late one night I was wakeful and feeling quite uneasy, when a horse came at a swift gallop into the garrison; from the Mexican spurs clanking on the board walk, I knew the rider could be none other than a courier from the front. Jumping from my bed, I ran to the top of the stairway, for the courier had stepped on the front porch. We lived in a double set of quarters, the commanding officer on one side and the surgeon on the other. I

listened with almost breathless anxiety and heard the courier speak of a battle. Then Mrs. Grover, the wife of the commanding officer called to me: "They have had a battle, your husband is safe and here is a letter from him to you. The courier brought a lot of letters but I have no one to deliver them." I said "Give them to me, I will deliver them." After I had read the consoling words that my dear one was well and in charge of the wounded on his way back to Fort Lapwai, I ran out into the black night with the bundle of letters directed to others. I did not have to ring or rap at any door; all were on the lookout for news and had heard me running on the board walk.

Dr. Sternberg was on the way, anxiously pushing along the route hoping to get the wounded safely into Fort Lapwai. The wounded were doing as well as could be expected on the rough journey. The next courier to Fort Walla Walla came with a letter saying that if I could bring a good servant my husband would be very glad to have me join him at Fort Lapwai. After consulting June, a faithful Chinese cook, I read him the letter and asked him if he would go with me, adding some information in regard to the station's proximity to the Indians. He looked thoughtful for a moment, then he inquired, "You go?" and I said "Yes, if you will go with me," whereupon he agreed to go. General Grover made all the necessary arrangements for me to go in the morning by train to Wallula and by the boat up the river.

We arrived in due time at Lewiston. There awaiting the steamer I saw Dr. Sternberg looking for me and my Chinaman. As we walked up the steep incline from the river to the hotel my husband looked at me and said: "The whole situation has changed so since I asked you to come that I am not sure that I do not owe it to you to send you immediately home again." I laughed and said "I don't want to be sent home and where you are is home for me."

The scenes were just a little more exciting than usual for everywhere there were soldiers, ammunition and cannons. The very atmosphere seemed full of something unusual and warlike. A large conveyance came to take us to Fort Lapwai, 12 miles distant, and we were soon on the way. At an abrupt turn I had my first glimpse of the fort. Not long after we were

passing numbers of reservation Indians on their way to visit the Indian prisoners recently sent to Fort Lapwai, there to be kept under guard. We passed the hospital, then the stockade, the guardhouse, and entered the gate to an enclosed parade ground. The first house to the right on the officers' row was that of Colonel Perry, who had turned it over to Dr. Sternberg during his stay at Lapwai. Officers continued to pass through the post every day, there was no place, no mess, really no home, where they could rest and get refreshment. Consequently we seldom had a meal alone and often I would be asked by my hospitable husband to do the best I could for some poor fellow who had just arrived almost exhausted from a long ride. We lived with the doors wide open, and at night we slept lightly, to be able to rouse easily for any emergency. The guns stood in the best positions for quick seizure in case they were needed. The only soldiers at the post for all guard duty were about twenty men left from one of the regimental bands. We knew that in case of need these men would be dependable and brave, though they had not been drilled and were not expected to fight. Early in the war a block house had been established in one of the houses in the officers' row, and casks of water and provisions were kept in the cellar. Cord wood had been stacked all around the house to protect it from shot and all the women and children had been instructed in case of attack to take shelter there.

The Indian prisoners became discontented and restless in their confinement, while the number of friendly visiting Indians increased daily. The ladies grew more and more nervous in regard to the number of prisoners and the very few soldiers, while the Indian Agent was uneasy about the constant intercourse between the Reservation Indians and prisoners. Settlers periodically started rumors that Joseph had evaded General Howard and was on his way back. A report to Washington on the conditions relating to the Reservation Indians and the prisoners of war brought an order for the removal of the latter to Fort Vancouver or some other place. Never shall I forget the deep moans, and the peculiar cries of the Indians when informed they were to be sent away. The Reservation Nez Percés flocked near the stockade to sympathize with and to say good-bye to these poor forsaken human beings leaving forever their own country. They cut necklaces of beads from their

persons, and beaded work from their clothing, and threw moccasins over the stockade as parting gifts. A remnant of a brave race was leaving forever a beautiful valley that had once been their home.

In the stillness of a night I heard a footfall on the board walk and up the front steps into our house, and a voice saying hastily, "Dr. Sternberg, the packer is bleeding profusely from his leg." My husband jumped from his bed and called to the man "Put on the tourniquet, put on the tourniquet, I will be there in a moment." And in a few seconds he was on his way. On his return he confided to me he had experienced no end of care and anxiety with this patient because he would not consent to amputation. It was feared the man would lose his life and though repeatedly informed of that possibility, the wounded man had replied that he would rather lose his life than his leg. Soon after this the crisis came and he was obliged to face the inevitable, and he gave his consent to operation then at much greater risk than would have been experienced earlier. We often saw him at a later date in Walla Walla. He would invariably come to the carriage to say "Let me kiss the hand that saved my life." This recalls to my mind the same sentiment expressed by a poor colored man in Florida upon whom Dr. Sternberg had operated for a cataract. The operation was a success and the man to whom sight had been restored never allowed Dr. Sternberg to pass without running to kiss his hand.

After the removal of the Nez Percés with their wives and their children, there was a wave of quiet prevailing at Fort Lapwai for a few hours. The Army news was that Gen. Frank Wheaton had arrived with his regiment from Georgia to join the forces in the field. Scouting parties were sent in every direction to see if any traces of the Nez Percés could be found in the old hunting grounds and in our vicinity. The settlers were in a constant state of stampede because of the rumors. After a thorough search it became quite evident that the non-treaty Indians and their allies were not lurking in their old haunts. Meantime Colonel Green with a cavalry force from Fort Boise had joined the army in the field. Some of his troops aided General Howard in the pursuit of Joseph over the Lolo trail, while he and two troops of cavalry remained at Mount

Idaho to intercept returning or renegade Indians. General Howard was moving over the Lolo trail into Montana and soon Fort Lapwai would only hear from them through couriers and officers on business. The wounded and the sick in the hospital were at this time all doing well, many of them moving about the garden or sitting on the porch. In the meantime more surgeons had come with the troops into the Department of Columbia and it was decided to send Dr. Sternberg to his post at Walla Walla. This was a welcome change for he had endured great hardship and much exposure, after which the prospect of a rest was greatly appreciated.

EARLY WORK ON DISINFECTANTS

November 2, 1878, Dr. Sternberg received a telegraphic order to represent the Medical Department of the Army at the meeting of the American Public Health Association, in Richmond, Va., November 19. The date of the meeting gave very limited time for crossing the continent, and on inquiry, it was learned that he could not go east by way of Portland and San Francisco (the most comfortable route) and reach Richmond in time for the meeting. He was therefore obliged to take the stage route to the Central Pacific R. R. at Winnemucca, Nevada, a long rough trip of nearly 450 miles. The meals furnished at the station en route were so unwholesome, consisting largely of bacon, fried potatoes and hot bread, that indigestion soon added to the discomfort of all the passengers. A lady passenger and Dr. Sternberg both fainted in the stage in consequence of the hardships encountered in making this frontier trip. The cordial greetings of professional friends, participation in the discussions of able papers, and the inspiration that came from contact with men of sympathetic interests, all served to fire him with renewed ambition. He returned home from the scientific meeting determined to solve some interesting problems on which he had previously worked.

In addition to his professional post work at Fort Walla Walla, Dr. Sternberg had quite a large outside practice, yet in 1878 he began experiments to determine the practical value of commercial disinfectants, a line of work with which his name henceforth became conspicuously identified until the question was finally and satisfactorily settled. He had previously given

much time and thought to this work, and he deserves great credit for what he accomplished in this remote place even at that date. With no facilities for scientific experiment except those he improvised, and with only such materials as were at hand, he began a work of great practical and scientific value. The work reached its conclusion in 1885, and served to bring him renown. To quote from an expert in this field:

No one unless familiar with bacteriological work can have the slightest conception of the magnitude of the painstaking labor involved in the determination of the thermal death point of pathogenic organisms, and the germicidal value of certain chemical and physical agents. It required daily and exacting application, extending over a period of years, but it was a glorious work in the battle against infectious diseases. The eradication of preventable diseases is the highest aim of scientific medicine today, and in this field Dr. Sternberg was one of the chief foundation builders.¹

April 18, 1879, a telegraphic order relieved Dr. Sternberg from the post at Walla Walla and directed him to report to the Surgeon-General at Washington, D. C. In our service at Army posts I always became much attached to our friends and to our many homes. I was in consequence very sad when we were again required to bid adieu to pleasant surroundings. On inquiry we learned that our belongings could not be shipped across the continent at a reasonable rate. The railroad officials were clever in those days: if your things were heavy, the company weighed them; if they were crated and bulky, they measured them and charged accordingly. I knew we could never replace some of our household treasures, but there was no alternative, and we were forced to let them go. In disposing of our horses we tried to give them good homes, where they would be kindly treated. In due time we had again crossed the continent.

1. Kober, G. M.: Sternberg the Scientist and Author, Address delivered at the complimentary dinner to Gen. George M. Sternberg. Washington, 1908.

CHAPTER EIGHT

SCIENTIFIC RESEARCH

Dr. Sternberg was very happy as we approached the East and were near the end of our journey. He knew that in the East he was to have opportunity; that he would be able there to pursue under favorable conditions the scientific and sanitary research on which he was engaged. There he would be in touch with men interested in his line of endeavor, and with the modern developments of research work. On our arrival in Washington, Dr. Sternberg was detailed for duty with the Havana Yellow Fever Commission of the National Board of Health. We arranged for a very quiet life, so that he could give his entire attention to the microscopical work in connection with the examination of the blood and tissues of yellow fever patients. He spent a great deal of time in working with high power lenses and in making photomicrographs, as a new and valuable method for illustrating his future research work. Photomicrography proved very fatiguing work, requiring much time and great care and patience. The entire process was so delicate that frequently the jar of a wagon passing on the street would throw an object out of focus and so result in great disappointment. Yet Dr. Sternberg never lost faith in this process, as he indicates in a paper presented to the Microscopical Society in 1892. He considered photomicrographs far superior to handmade drawings, in that they show in a very satisfactory manner the structural details of microscopic objects, because they exclude those errors which result from faulty drawings, careless observation, or suppression and exaggeration of detail due to personal bias. They are unimpeachable evidence of what has been seen under the microscope, and as such, will always have special value as illustrations for original research work relating to the morphology of micro-organisms or histological details of animal and vegetable tissue. The art of making photomicrographs had its origin in this country at the Army Medical Museum in Washington, where Dr. Curtis made the first successful effort and Woodward achieved remarkable success in photographing

difficult test diatoms, etc. Dr. Robert Koch, the famous German bacteriologist, first employed this method in illustrating some of his papers relating to bacteria, and published many admirable photomicrographs, as long ago as 1877.

THE HAVANA YELLOW FEVER COMMISSION

The Yellow Fever Commission consisted of Dr. Stanford Chaillé of New Orleans (Chairman), Mr. Hardue, civil engineer of New Orleans, Dr. Sternberg (Secretary), and Dr. Juan Guiteras of Havana. Later, through Dr. Sternberg's letters, I was made acquainted with his newly acquired friends residing in Cuba, Dr. Carlos Finlay with whom he became intimate, Dr. Emiles Martinez, Dr. Tincende de la Suardia of the Charity Hospital, Dr. D. M. Burgess, United States Sanitary Inspector and practising physician in Havana, and other professional men who were intensely interested and very helpful in the work.

The Yellow Fever Commission received the following instructions from the National Board of Health.

First: to ascertain the actual sanitary conditions of the principal ports of Cuba from which shipments are made to the United States. Second: to increase existing knowledge as to the pathology of yellow fever. Third: to obtain as much information as possible with regard to the so-called endemicity.

In the division of labor made by the members of the Commission, the duty of conducting the investigations under the first and third of the above instructions was assigned to the chairman, Dr. Chaillé, those under the second heading to Dr. Guiteras, while the attention of Dr. Sternberg was to be given chiefly to investigations contemplated in the following additional instructions:

But in addition to these the National Board of Health desires that the Commission shall consider certain problems relating to the disease, problems which may be entirely insoluble, but which nevertheless are of such importance that an effort should be made to decide whether the National Board of Health will be justified in undertaking the labor and expense, which will probably be required to obtain anything like a complete solution of them, if such solution is at all possible. These problems relate to the nature and natural history of the cause of yellow fever.

Like all his writings, my letters from him contained information clearly stated and always comprehensive. I had taken a great interest in his preparatory work, because he was kind enough to wish me to know his aims. In conversations at home he patiently explained matters with the greatest care and detail, thereby educating me up to a point of intelligent interest. His letters continued to bring a reasonable amount of detail of his laboratory work and kept me in touch with his surroundings and ambitions. Dr. Sternberg's own experience, the observations of Dr. Joseph Jones of New Orleans, of Dr. Cockran of Mobile, Ala., and in fact of all medical men with extensive and excellent opportunities for observation in hospital and private practice, agreed that the prominent symptoms of yellow fever indicated that the causative organisms would possibly be found in the blood of patients suffering with the disease. Dr. Sternberg consequently gave much of his time to microscopic examination of the blood of patients in all stages of the disease, and in making a photomicrographic record of all cases. At one time ninety-eight specimens from forty-one undoubted cases of yellow fever were carefully studied, and 105 photographic negatives were made.

In Cuba Dr. Sternberg used sunlight reflected by a heliostat, and he worked in a dark room which constituted the camera. Many of the photomicrographs he made at that time won commendation from experts, while some of them have never been equaled. One who knew Dr. Sternberg intimately has spoken of his reputation for "clear statements of the results in his experimental data." The enormous labor he bestowed on the perfection and simplification of technic will always be appreciated by research workers. It is not generally known that Dr. Sternberg was the pioneer in bacteriology in the United States; there were, in fact, no workers in pure bacteriology in this country when he entered the field. He gave to his profession services the importance of which was not generally appreciated at that time, except by a few scientific men and students who came in contact with him.

In 1880 I was made very happy by the receipt of a letter telling me the Yellow Fever Commission was preparing to return home. A date had been fixed for leaving Havana, though a great deal of time was required for packing the valu-

able material which was to be kept for future reference. We remained in Georgetown (D. C.) while Dr. Sternberg was engaged in writing his report. The next meeting of the National Board of Health was for him a great event. Friends were cordial in their greeting and his preliminary report was well received. Soon thereafter he was again at work in the laboratory going over his field notes and cultivating various bacteria which he had isolated and brought home with him for experimental work and further study. While in Havana he had examined many specimens of blood from patients in all stages of yellow fever, but thus far the specific germ had evaded his faithful search. Enough had been accomplished to convince him and members of the profession especially interested in the research that greater progress must be made in the new science of bacteriology before definite conclusions regarding the causative organism of yellow fever could be reached and proclaimed.

The following quotation shows Dr. Sternberg's appreciation of the magnitude of his task:

I might well have hesitated before undertaking this unpromising investigation if the language of our instructions had implied that the National Board of Health considered this an easy task and one which was expected would be accomplished during our brief stay in Havana, but you will observe that no such result was anticipated, that the difficulty of the undertaking was fully appreciated and that the work of the Havana Commission in this direction was looked upon as pioneer work to decide whether the National Board will be justified in undertaking the labor and expense which will probably be required to obtain anything like a complete solution, if such solution is at all possible.

Dr Sternberg had faith that science and painstaking work would eventually solve the problem, but he knew enough of the disease to have little expectation that three months' work in Havana would do more than clear away some of the obstructions from the path of future investigators.

STUDIES OF MALARIA

Under instructions from the National Board of Health, Dr. Sternberg proceeded to New Orleans in 1880 to investigate the micro-organisms in the air, and to make a study of malarial

fever. He very soon arranged his temporary laboratory and was speedily interested in making cultures from plates exposed in the air or from specimens of mud from the gutters and elsewhere.

The important announcement that Laveran, a French army surgeon at that time stationed in Algeria, had discovered the organism of malarial fever, induced the National Board of Health to have Dr. Sternberg verify these claims. It happened that one year before the publication of Laveran's paper, the distinguished German pathologist Klebs in association with a prominent Italian physician, Tommasi-Crudeli, had announced the discovery of a bacillus which they believed to be the true cause of the disease. Their investigations were made in Rome, with material obtained from the malarial marshes in the vicinity of that city. The instructions of Dr. Sternberg were "to make control experiments in a recognized malarial locality in this country." In 1881 he made his report, based upon repeated cultures and animal experimentation. His task was difficult and unpleasant, and every line of thought was followed out before final negative conclusions were reached and given out. He made a clear and positive statement of his work and proved conclusively that the so-called "bacillus malariae" of Klebs and Tommasi-Crudeli has nothing to do with the causation of malarial fevers.

At the time of this report on the results of control experiments with the Klebs and Tommasi-Crudeli bacillus, the public and medical profession had quite generally accepted and favored the claim of these men, but Dr. Sternberg never wavered in his conviction that they had made a mistake, and he stood firmly by his experimental data. Today, no one speaks of the bacillus of Klebs-Tommasi-Crudeli, except as one of many pseudo-discoveries. It is regrettable that so much of Dr. Sternberg's time had to be given to the negative phase of scientific research, that of confirming or refuting theories and conclusions of other investigators.

DISCOVERY OF THE PNEUMOCOCCUS

In February, 1881, Dr. Sternberg discovered a pneumococcus which is now recognized as the pathogenic agent of croupous pneumonia, and which he found to be constant in his own

sputum. This micro-organism he also found to be identical with the organism described by Dr. Pasteur, Jan. 24, 1881, in a communication to the Academy of Sciences of Paris.¹ Priority is therefore accorded to the latter in accordance with the usual law (priority of publication). Both Dr. Pasteur and Dr. Sternberg found that this bacillus produced septicemia in inoculated animals and assumed it to be the pathogenic agent of this disease. Dr. Sternberg's communication, published in the Bulletin of the National Board of Health, April 30, 1881, is as follows:

In a report (not yet published) made to the National Board of Health in February last, I have given a detailed account of certain experiments, made in the first instance as a check upon experiments relating to the so-called *Bacillus malariae* of Klebs and Tommasi-Crudeli, which show that my own saliva has remarkable virulent properties when injected into the subcutaneous connective tissue of a rabbit. Further experiments, made in the biological laboratory of the Johns Hopkins University, have fully confirmed the results heretofore obtained, and the object of the present report is to place upon record these last experiments, which are of special interest just now because of the announcement by Pasteur, of "*a new disease*," produced in rabbits by the subcutaneous injection of the saliva of an infant which died of hydrophobia in one of the hospitals of Paris.

I have demonstrated by repeated experiments—

That my saliva in doses of 1.25 c.c. to 1.75 c.c.² injected into the subcutaneous connective tissue of a rabbit, infallibly produces death, usually within forty-eight hours.

Query. Do similar results follow the injection of other fluids containing organic matter in suspension or solution?

Answer. One c.c. of my own blood failed to kill a rabbit; 1 c.c. of putrid urine containing *B. termo* in abundance failed to kill a small rabbit; 1 c.c. (each) of liquid feces and distilled water, (1 to 10), failed to kill two rabbits; 1.25 c.c. of bouillon undergoing putrefaction and loaded with *B. termo*, failed to kill a rabbit; 1 c.c. of sediment from Baltimore water, consist-

1. Pasteur, L.: Sur une maladie nouvelle provoquée par la salive d'un enfant mort de rage. Compt. rend. Acad. d. sc. de Paris 92:159, 1881.

2. I have commonly injected an amount varying from 5 to 25 minims, according to the size of the animal, but in small rabbits have had a fatal result in three cases out of five follow the injection of 1 minim diluted with 5 minims of water.

ing of organic *débris* and organisms—chiefly *Bacillus subtilis*, *Leptothrix pusilla*, *Protococcus*, and a few diatoms and flagellate monads, failed to kill a rabbit.¹

On the other hand, injections of a small quantity of surface mud from the gutters of New Orleans during the month of September, 1880, invariably produced fatal results within forty-eight hours. (See unpublished report above referred to.)

Query. Does the saliva of other individuals injected in the same manner produce similar results?

Answer. The saliva of four students, residents of Baltimore, (in March), gave negative results; eleven rabbits injected with the saliva of six individuals in Philadelphia, (in January), gave eight deaths and three negative results; but in the fatal cases, a less degree of virulence was shown in six cases by a more prolonged period between the date of injection and the date of death. This was three days in one, four days in four, and seven days in one.

Query. Is there any recognizable peculiarity in the saliva which exhibits the greatest degree of virulence?

Answer. In the case of Dr. S., whose saliva shows an exceptional virulence, the teeth are sound, the secretions of the mouth normal in physical properties and reaction, and the general health good. There is, perhaps, an unusual flow of saliva, but no other noticeable peculiarity.

Query. Is there any plausible hypothesis by which this difference in virulence can be explained?

Answer. This question will require for its solution more extended experiments. In the meantime it may be mentioned, as having a possible bearing upon the subject, that Dr. S. has been engaged to a considerable extent, during the past two years, in studies which have brought him in contact with septic material. Dr. F., of Philadelphia, whose saliva killed (after a longer interval) two rabbits, is pathologist to a large hospital, and consequently is constantly brought in contact with septic material. Mr. N. and Mr. B., whose saliva killed all the rabbits operated upon, (four), are residents of seaport towns in Cuba.²

1. Coze and Feltz found, as the result of numerous experiments, that the blood of healthy persons, and that of persons sick with non-infectious maladies, does not produce fatal results when injected into the subcutaneous tissue of rabbits. (Clinical and Exp. Researches upon Infectious Maladies, 8°, Paris, 1872). Pasteur also has inoculated, without result, the saliva of asphyxiated rabbits and of men dead with common diseases (*l.c.*).

2. The possibility that this septic condition of the secretions of the mouth may bear some relation to the protection which these Cubans and myself enjoy against yellow fever, which is a disease presenting many points of resemblance to septicæmia, has occurred to me, and without, at present, laying any great stress upon this possibility, I think it worthy of further experimental considerations.

Query. Is death produced in other animals by the subcutaneous injection of human saliva, which is virulent for rabbits?

Answer. Injection of 4 c.c. into each of two small dogs produced local abscesses at point of injection, but no other noticeable result.¹ Injection of 0.25 c.c. (each) into five chickens produced no result. Injection of 0.75 c.c. (each) into three guinea-pigs proved fatal to two—one in three and one in seven days. Injection of 0.5 c.c. into five rats resulted fatally to one only.²

Query. What is the nature of the fatal malady produced in rabbits by the subcutaneous injection of the saliva of certain individuals?

Answer. The course of the disease and the post-mortem appearances indicate that it is a form of *septicæmia*. Immediately after the injection there is a rise of temperature, which in a few hours may reach 2° to 3° centigrade, (3.6° to 5.4° Fah.); the temperature subsequently falls, and shortly before death is often several degrees below the normal. There is loss of appetite and marked debility after twenty-four hours, and the animal commonly dies during the second night or early in the morning of the second day after the injection. Death results still more quickly when the blood from a rabbit recently dead, is injected. Not infrequently convulsions immediately precede death.

The date and mode of death correspond with that reported by Pasteur in the memoir referred to. Two rabbits injected with buccal mucus from the mouth of a child recently dead with hydrophobia, December 11, were found dead December 13. Other rabbits inoculated with the blood and saliva of these died in still less time. Inoculations with fresh blood usually produced death in less than twenty-four hours.

The most marked pathological appearance is a diffuse inflammatory œdema or cellulitis, extending in all directions from the point of injection, but especially to the dependent portions of the body. Occasionally there is a little pus near the puncture, but usually death occurs before the cellulitis reaches the point of producing pus. The subcutaneous connective tissue contains a quantity of bloody serum, which possesses virulent properties, and which contains a multitude of micrococci.

1. A dog succumbed, however, to an injection of 1 c.c. of serum from the subcutaneous cellular tissue of a rabbit recently dead.

2. The results obtained by me in these experiments correspond with those reported by Pasteur in the paper already referred to, viz: guinea-pig less susceptible than rabbit, complete immunity of the chicken, and susceptibility of the dog to the "new disease" as the result of injections of blood from dead rabbits.

There is usually more or less inflammatory adhesion of the integument to the subjacent tissues. The liver is sometimes dark colored and gorged with blood, but more frequently is of a lighter color than normal, and contains much fat. The spleen is either normal in appearance or enlarged and dark colored. Changes in this organ are more marked in those cases which are of the longest duration. In certain cases dark colored pigment has been found in the spleen, resembling that which has been supposed to be characteristic of malarial fever. The blood is dark colored, usually fluid, and there is a tendency to agglutination of the red corpuscles.

The blood commonly contains an immense number of micrococci, usually joined in pairs, and having a diameter of about $0.5\ \mu$. These are found in blood drawn from superficial veins, from arteries, and from the cavities of the heart immediately after death, and in a few cases their presence has been verified during life; observations thus far made indicate, however, that it is only during the last hours of life that these parasites multiply in the circulating fluid, and in a certain proportion of the cases a careful search has failed to reveal their presence in post-mortem examinations made immediately upon the death of the animal. This organism, however, is invariably found in great abundance in the serum which exudes in considerable quantities from the oedematous connective tissue when an incision is made through the integument over any point involved in the inflammatory oedema extending from the original puncture.

A perusal of the paper of Pasteur, already referred to, has induced me to pay special attention in three recent postmortems to some points to which this author refers, which I had not noticed in previous examinations, viz: to the condition of the trachea, the lungs, and the lymphatic glands in the groins and axillae.

Pasteur says, "The cellular tissue is almost always emphysematous." (This has not been observed to be the case, except to a slight extent in one instance in the rabbits operated upon by me.) "The lungs are frequently filled with *noyaux* of pulmonary apoplexy." (I have found this to be the case in one out of three rabbits examined since my attention has been directed to this point.) "A character more constant than the last (not more constant, however, than that which relates to the volume and color of the *ganglions*), is the state of the trachea, which is almost invariably red, congested with little hemorrhages from the smallest vessels." (I have found a marked congestion of the vessels of the trachea in the three cases in which I have examined it, and in one case the lymphatic glands of the axillae were enlarged and congested.)

Query. What constituent of the saliva injected produces the fatal malady in question?

Answer. The following facts demonstrate that the phenomena detailed result from the presence of a living organism found in the saliva—a micrococcus—which multiplies abundantly in the subcutaneous connective tissue, and also in the blood shortly before or after death.

(a) *The poison is particulate.* This is proved by numerous filtration experiments. *Example:* March 15, 11 a. m. Injected 1 c.c. of filtered saliva (filtered through thin stratum of plaster of Paris, by means of Sprengel's pump) into left flank of rabbit weighing 1 pound, and at the same time one-fourth the quantity of unfiltered saliva into a rabbit of the same size. No harm resulted to the first rabbit, while the second died the following day, at 5.30 p. m.

(b) *The virulence of the saliva is destroyed by boiling.*

(c) *The saliva loses its virulence when kept for twenty-four hours in a culture chamber, at a temperature of 37° centigrade.*

(d) *The addition of one part of a 10 per cent. solution of carbolic acid to two parts of saliva destroys its virulence.*

(e) *The effused serum from the subcutaneous connective tissue of a rabbit recently dead, produces death attended with the same phenomena as resulted from the injection of the saliva in the first instance.* But this does not contain epithelial cells or salivary corpuscles, and we are, therefore, justified in excluding these as possible agents in the production of the results indicated. Moreover, these are present at all times in the saliva of all individuals, while virulence, at least such an intense degree of virulence, is an exceptional property of human saliva.

(f) *This serum loses its virulence by filtration.*

Unfiltered serum from a recently dead rabbit has invariably proved fatal in smaller quantity and in less time than is required by the saliva in the first instance, showing an increase of virulence as the result of successive cultivation of the organism in the body of a susceptible animal. This corresponds with the results obtained by Davaine, Koch, Pasteur, and others. I have not attempted to ascertain the minimum quantity which will produce death. Davaine says: "A rabbit may be killed by the $\frac{1}{1000}$ part of a drop of septic blood."

NOTE.—The presence of *B. Termo* and an odor of putrefaction in saliva kept for twenty-four hours in a culture chamber shows that changes are occurring which have heretofore been recognized as destructive of the septic poison (organism), *e. g.*, the virulence of the poison which produces dangerous dissection wounds is lost when putrefactive changes set in.

(Bull. de l'Acad. de Méd., 2 s., t. viii, p. 121.) In my filtration experiments I injected, however, quantities far in excess of the amount required to produce speedy death if unfiltered serum had been employed.

Example: March 14. Injected 2 c.c. of filtered serum (from subcutaneous connective tissue of rabbit recently dead) diluted with distilled water (1 to 20) without result, while one-quarter the quantity (0.5 c.c.) of the same dilution *unfiltered*, injected at the same time into another rabbit, produced death in twenty-four hours.

(g) *The micrococcus present in the serum from the connective tissue of a rabbit which has succumbed to a subcutaneous injection of saliva, may be cultivated in bouillon made from the flesh of a healthy rabbit, or in blood serum from a healthy dog, and these fluids thereby acquire a virulence which they did not have before.*

My first efforts to cultivate the micrococcus in urine, in gelatine solution, and in bouillon made from the flesh of a dog, all proved ineffectual, and these fluids after inoculation with blood or serum from the connective tissue, showed a temporary virulence only, which was doubtless due to the presence of the micrococci introduced, which preserved their vitality for a certain time, although the conditions were not favorable for their increase. After a few days the first culture lost its virulence and successive inoculations gave negative results, both as to the presence of the micrococcus and as to noxious properties when injected into rabbits.

(h) *Successive cultures in which but a small drop is taken each time to inoculate a fresh quantity of bouillon exclude the white and red blood corpuscles (filtration experiments have already shown the poison to be particulate) as possible agents in the production of this virulence, and prove conclusively that the veritable cause is the presence of a micrococcus, found first in the saliva, then in the serum from the connective tissue, and (usually) in the blood of the animal killed by the injection of saliva, and finally in each successive culture fluid inoculated, (in the first instance), with a small quantity of this serum or blood.*

Within a few hours after inoculating sterilized bouillon made from the flesh of a rabbit (first tested for several days in a culture oven at a temperature of 37° cent.) with blood, or serum from subcutaneous connective tissue of a rabbit recently dead, the fluid—previously transparent—becomes opalescent, and upon microscopical examination is found to contain innumerable micrococci, solitary, in pairs, and in torula chains. The same result follows upon inoculating a second portion with a minute drop from the first, and so on. The continued virulence of these successive cultures I have amply proved.

Example: April 13. Injected 1 c.c. of bouillon culture No. 6 (six successive inoculations, the first with serum from subcutaneous connective tissue of rabbit), into left flank of a large rabbit. *Result:* The animal was found dead on the morning of the 16th, and presented the usual appearances upon *postmortem* examination. Its blood and the effused serum in subcutaneous connective tissue contained, as usual, an immense number of micrococci, like those already described.

Query. Does the micrococcus found under the circumstances detailed differ from the *Micrococcus septicus* of Cohn, and is it identical with the organism described by Pasteur, as present in the blood of rabbits killed by the subcutaneous injection of the saliva of an infant dead from hydrophobia, (l.c.)?

Answer. Cohn describes the *M. septicus*, as follows:

"Little rounded cells, of 0.5μ , motionless and crowded in masses, or united in chaplets in the secretion of wounds in cases of septicæmia (Klebs), in *zooglæa* in callous ulcers, in isolated cells, united *in pairs*, or in chaplets in the serum of *epidemic puerperal fever* (Waldeyer), in all the tissues, vessels, etc., in cases of pyæmia and septicæmia." (Magnin: The Bacteria, Boston, Little, Brown & Co., 1880, p. 76.)

Pasteur gives the following description of the micrococcus found by him in the fatal disease described by him as new, and which he evidently does not consider identical with septicæmia, a disease which he had previously studied experimentally. It should be noticed, however, that Pasteur recognizes several forms of septicæmia. Thus he says:

"And now we see why septicæmia has so often been confounded with charbon; their causes are of the same order; it is a vibrio which causes septicæmia and a bacillus which produces charbon. * * * Septicæmia and putrefaction in a living being are not the same thing. *There are as many different septicæmias as there are different vibrios.* * * * In septicæmia the vibrios do not appear in the blood until the last thing, but in this liquid one of them takes a peculiar aspect, often longer than the diameter of the field of the microscope, and so transparent that it easily escapes observation; when, however, it is once perceived it is easily found again, flexible, climbing and removing the blood globules as a serpent moves the grass in the bushes," etc. (Charbon and septicæmia, C. R. Ac. des Sc., lxxxv, 101-115.)

This septic vibrio of Pasteur I found in the blood of rabbits, victims of my experiments, in New Orleans during the past summer (Report to National Board of Health, not yet published), but have not since met with it; perhaps because it develops *post mortem* and requires hot weather of summer for its development. Whether it is an independent organism or

is developed under special conditions from the *Micrococcus septicus*, being an advanced phase in the development of this organism corresponding with the spore-producing filaments which have been shown to constitute one phase in the life-history of *Bacillus anthracis* (Koch) and of *Bacterium termo* (Ewart), is an interesting question for further research. The vivid language of Pasteur describes it well, and the wonderful vigor with which this extremely slender and almost transparent organism thrusts aside the blood corpuscles in its impetuous serpentine movements cannot fail to astonish the observer. The micrococcus of Pasteur's "new disease" is, on the contrary, quite motionless, and is described as follows:

"This organism is sometimes so small that it may escape a superficial observation. Its form does not differ from that of many other microscopic beings. It is an extremely short rod a little compressed towards the middle, resembling a figure 8, and of which the diameter of each half often does not exceed a half a thousandth of a millimeter [$=0.5\mu$ and corresponding with the diameter given by Cohn for the *Micrococcus septicus*, also with the micrococcus observed by myself in the form of septicæmia described in this report]. Each of these little particles is surrounded at a certain focus with a sort of aureole which corresponds, perhaps, to a material substance." (NOTE.—The possibility that this appearance is due to diffraction is considered, but Pasteur inclines to the opinion that in the case in question it is due to a mucous substance which surrounds the organism.)

The foregoing descriptions answer as well for the micrococcus observed by me as if they had been written especially for it, and it is unnecessary for me to say more at present in relation to the morphology of this organism, which apparently is identical with that of the *Micrococcus septicus* of Cohn, and with the organism found by Pasteur in the "new disease" described by him. Does it then follow that the organisms are identical, and that the phenomena related by Pasteur, as resulting from the subcutaneous injection of saliva from an infant dead of hydrophobia, and by myself, from saliva of a healthy adult, represent the same disease? By no means. The man of science soon finds that things which look alike are not necessarily of the same kind. Thus of two transparent colorless fluids, one may be harmless water, and the other a corrosive acid; two embryos apparently alike, may develop the one into a man and the other into a monkey; two seeds of the same size and general appearance, may produce the one cabbage, the other a turnip, etc.

The argument, then, that because a certain bacillus, or spirillum, or micrococcus, is morphologically identical with another, which is proved to be harmless as to its effects upon an animal organism, consequently it must be harmless, has no support from analogy any more than it has from experiment. And it is high time that naturalists and physicians should open their eyes to the fallacy of such an argument, as it not only has a tendency to close the minds of those who receive it to the reception of demonstrated truth, but also acts, to some extent, as a bar to the progress of science in this direction. The argument is: Bacteria are found everywhere, we eat them, we drink them, we draw their germs into our lungs at each inspiration and without apparent injury. They are evidently harmless. Your spirillum of relapsing fever does not differ (the morphological resemblance is admitted) from a harmless spirillum frequently found in the human mouth; your *Bacillus anthracis* does not differ from *Bacillus subtilis*, etc. The answer is plain. The fact that there are harmless bacteria does not disprove the possibility of pathogenic bacteria; the fact that two things look alike does not prove that they are alike; experiment proves conclusively that the phenomena of anthrax are due to the presence and multiplication in the body of the affected animal of the *Bacillus anthracis*, and that in the fatal form of septicæmia described in this report, the efficient cause of the morbid phenomena, and of death is the minute micrococcus described.

Doubtless, harmless micrococci abound. Pasteur finds no difference, morphologically, between the organism which produces the "new disease" described by him and that which produces the *cholera des poules*. He says: "By the form which it has in the blood the organism resembles the microbe of chicken cholera, but it differs completely in its functions. We may inoculate fowls with it without their experiencing the slightest ill effect." (The same is true of the organism producing the form of septicæmia described in this paper.)

"In the form of chaplets it resembles greatly many other organisms which I have often observed," etc.

It will have been noticed from the account already given that the fatal disease in rabbits observed by me and resulting from the subcutaneous injection of my own saliva resembles in many particulars the disease described by Pasteur as new, resulting from the subcutaneous injection of the saliva of a child dead with hydrophobia. Another point of resemblance is the fact that the saliva of one of my rabbits, recently dead, has the same virulence as the blood and serum from connective tissue. A serous liquid, which in some instances escapes from the bowels shortly before or after death, also contains the micro-

coccus in abundance and possesses like virulence. All of these points of resemblance form a strong probability in favor of the identity of the two diseases, but I am not prepared to pronounce a positive opinion upon this point, especially since Pasteur, who had previously given much attention to the study of septicæmia, pronounces the disease observed by him to be new, while I see no reason, at present, for supposing that the disease observed by me differs essentially from the experimental septicæmia produced by Davaine, Koch and other investigators, who, however, obtained their first supply of septic organisms from a different source.

In the light of what we already know, it seems very probable that puerperal fever, hospital gangrene, and the various forms of septicæmia known to physicians and surgeons result from the development of pathogenic varieties of harmless and widely-distributed species of micrococci, as the result of especially favorable surroundings, such as are found in the lochial discharges of a puerperal woman or in the secretions from the surface of wounds in a crowded and illy-ventilated hospital ward.

Just as differences in resisting power to experimental septicæmia are exhibited by different species of animals, so doubtless individual differences exist in man, especially as the result of lowered vitality; and this want of resisting power, from whatever cause resulting, must be counted as one of the conditions favorable to the development and propagation of a pathogenic bacterium. Thus we find that in experimental septicæmia the micrococcus does not invade the blood until the vital powers are at a low ebb, and death is near at hand.¹

In the dog the vital resistance is competent to withstand the assaults of a micrococcus—injected subcutaneously—having the potency of those found in my saliva, and the result of such an injection is simply a circumscribed abscess. But the increased power (which is perhaps simply a more vigorous and rapid development) gained by circulation in the body of the rabbit, enables these organisms to overcome the resistance of the dog, and a diffuse cellulitis results of fatal character.

The fact, observed by myself, that during the summer months the mud in the gutters of New Orleans possesses an extraordinary degree of virulence² shows that pathogenic

1. By virtue of some property or mechanism at present unknown, blood, which external to the body is a favorable medium for the development of many species of bacteria, resists their entrance or gets rid of them when they effect an entrance, *e. g.*, by injection, so long as it is circulating in the vessels of a healthy individual.

2. There is no reason to suppose that this is peculiar to New Orleans, but I have not yet had the opportunity to extend my experiments to other places.

varieties of bacteria are not alone bred in the bodies of living animals. The more I study this subject the more probable it seems to me that in this direction lies the explanation of many problems which have puzzled epidemiologists, and that the sanitarians are right in fighting against filth as a prime factor in the production of epidemics—a factor of which the rôle is easily understood, if this view is correct.

The presence of septic organisms, possessing different degrees of virulence depending upon the abundance and kind of pabulum furnished them and upon meteorological conditions more or less favorable, constitutes, in my opinion, the *epidemic constitution of the atmosphere*, which wise men were wont to speak of not many years ago as a cloak for ignorance. It must be remembered that the gutter mud of to-day, with its deadly septic organisms, is the dust of to-morrow, which in respiration is deposited upon the mucous membrane of the respiratory passages of those who breathe the air loaded with it. Whether the peculiar poison of each specific disease is of the same nature or not—a question which can only be settled by extended experimental investigations in the future—it is altogether probable that this factor often gives a malignant character to epidemics of diseases which uncomplicated, are of a comparatively trivial nature.

In July, 1885, Dr. Sternberg published a paper entitled "The Pneumonia-Coccus of Friedländer (*Micrococcus Pasteuri*, Sternberg).¹ In this paper he shows that the pneumococcus of Friedländer is identical with the organism discovered by Pasteur and himself. The paper begins as follows:

In this paper I desire to call attention to the so-called pneumonia-coccus of Friedländer, which I shall take the liberty of naming *Micrococcus Pasteuri*. My right to name the micrococcus discovered by Friedländer in the exudate of croupous-pneumonia must depend upon my ability to make good the claim which I here state, viz.: that the pneumonia-coccus of this author is, in fact, identical specifically with a micrococcus previously described by me, which is found in normal human saliva, and with that found by Pasteur in the blood of rabbits which had been injected with the saliva of a child who had died of hydrophobia in one of the Paris hospitals.

In attaching to this micrococcus the name of the illustrious French chemist I have no desire to perpetuate the memory of the mistake he made in supposing for a time that it was the germ of hydrophobia. Having found that this was a mistake,

1. Am. J. Med. Sc. 90:106 (July) 1885.

he did not fail to correct it; so no doubt Koch will do if he has made a mistake in announcing his "comma-bacillus" as the much sought cholera-germ. It is easy to make mistakes in this field of investigation; easier, perhaps, than to acknowledge them. And believing, as I do, in human fallibility, I have no hesitation in questioning the conclusions of the most illustrious workers in the field of micro-biology, if they are in conflict with my own observations. On the other hand, if, upon fuller investigation, I am convinced that I have been mistaken in regard to this or any other question, I shall feel no hesitation in following the example of Pasteur in making a public acknowledgment of my error. At all events the name will stand for the oval micrococcus which produces a fatal form of septicaemia in rabbits, and which is constantly present in my buccal secretions.

If I am right as to the specific identity of this micrococcus with the micrococcus discovered by Friedländer in the exudate of croupous-pneumonia, it does not follow that Friedländer is wrong in assigning to this organism an etiological role in connection with this disease. This is a question which I will not discuss at the present time, as I hope to make it the subject of experimental inquiry at as early a date as practicable.

In giving a specific name to a micrococcus which I first observed nearly five years ago, and which I have repeatedly studied by means of oil immersion objectives—the one-eighteenth and one-twelfth inch hom. im. of Zeiss—by the most approved methods of staining and cultivation, and by numerous experiments upon animals, I can scarcely be accused of undue haste. And, inasmuch as this is the first micro-organism which I have attempted to name among the multitude which I have encountered in the course of my bacteriological studies, I may be acquitted of any special proclivity for conferring names upon supposed "new species," as is the fashion among amateur naturalists.

I have heretofore spoken of this particular micrococcus as "the micrococcus of septicaemia in the rabbit"; but, as there is more than one form of infectious septicaemia in the rabbit known to us by laboratory experiments, each due to a different micro-organism, this term is evidently inexact. Moreover, it would indicate that this particular micrococcus finds its usual habitat in the blood of rabbits affected with the form of septicaemia to which it gives rise. This is by no means true, for the organism in question is widely distributed, and it is only by inoculation experiments that the fact has been developed that it is a pathogenic species, as far as rabbits are concerned. I made this discovery in the summer of 1880, quite accidentally, having injected a little of my own saliva under

the skin of a rabbit, as a comparative experiment, to ascertain whether a fluid supposed to be innocuous would give rise to any febrile disturbance. The promptly fatal result, and the presence of a multitude of oval organisms in the blood, at once aroused my attention, and, as is well known, I have since made numerous additional experiments, at different times and places, and always with the same result: The animals die in from 24 to 48 hours; they present the same pathological appearances; their blood is infectious in the smallest quantity, and it contains vast numbers of the oval micrococcus which I now name *Micrococcus Pasteuri*.

Upon making sections of the tissues of a rabbit dead from this form of septicæmia, the oval micrococci are found in great numbers in the capillaries of the various organs, as I am prepared to show. Repeatedly I have produced this infectious disease in rabbits by injecting beneath their skin pure cultures of the micrococcus in question.

All this is a matter of record, and the experimental proof is as definite as is that offered by Koch in regard to the fatal form of septicæmia in mice, which he has so well studied, or in the better known infectious disease, anthrax. Yet, in spite of my detailed record of experiments made, of my frequent repetition of these experiments, and of my photographs from nature which illustrate my first paper, published in 1881, and the article upon septicæmia in rabbits in my book, which was published more than a year ago, I find in Klein's recent work the following reference to my experiments:

"That saliva of the healthy dog, and of man inoculated subcutaneously into rabbits sometimes produces death in these animals (Senator) had entirely escaped his (Pasteur's) notice. Sternberg has proved this in an extensive series of experiments. His own saliva proved sometimes fatal to rabbits. They die of what is called septicæmia, and Sternberg thinks it due to the micrococci; but this is not to be considered as proved."

I claim that the fact is proved, and that the experimental evidence of this has been upon record for nearly four years, and I am prepared to repeat the experiments, and to demonstrate that such is the case. I look upon the fact that an infectious disease of a lower animal may be induced by inoculation with a micro-organism which is habitually found as a harmless parasite in the mouth of man, as something more than a curious circumstance to be recorded and forgotten, and as having an important bearing upon vital questions relating to the genesis of "disease germs," questions which are now largely occupying the attention of leading pathologists in all parts of the world. But in the discussion of these questions I must insist that experimental evidence obtained on this side of the

Atlantic is entitled to just as much consideration as that which comes to us from across the water. And, unless the truth of my detailed account of experiments made is impeached, I can only account for such a verdict as that which Klein has recorded in the sentence above quoted, upon the supposition that he has not read the evidence presented, or that he is controlled by a geographical bias, unworthy a true student of science, in estimating its value.

In connection with this organism an event which occurred in Berlin in 1886 will be related later. (See page 93.)

FORT MASON

Aug. 10, 1881, Dr. Sternberg was ordered to report again for army duty at San Francisco. On arriving there he was assigned to Fort Mason, a beautiful post, where the General in command of the Department of California, one company of artillery, with two company officers and staff officers, including one surgeon, constituted the garrison. Our quarters were in a charming little house on the side of a high bluff, overlooking the bay, while the post hospital, clean and bright, was just outside the garrison.

After our arrival at Fort Mason, Dr. Sternberg was not long in establishing at his own expense a laboratory for biological research. It was here in 1881 that he demonstrated and photographed the tubercle bacillus, discovered by Professor Koch earlier in the same year. I am informed on good authority that this was the first demonstration of the organism in America. The order relieving him from his experimental work in the East might have been so discouraging for many men that they would have given up the self-imposed task, but such was not the case with him. Every day after he had completed his rounds of post duties he worked faithfully in his study, completing experiments already begun and preparing to work intelligently on the subject of preventable diseases.

While our station at Fort Mason could not be excelled anywhere for comfort and social advantages, Dr. Sternberg longed for a more scientific atmosphere, and Nov. 27, 1883, addressed the following letter to Surg.-Gen. Robert Murray, U. S. Army:

GENERAL:—I would respectfully ask your attention to the following statements relating to my future career as a Medical Officer of the U. S. Army. It is my earnest desire to devote

my time to scientific and literary work and especially to microscopical and experimental studies relating to the etiology of infectious diseases. Since leaving the National Board of Health, Aug. 23, 1881, I have been obliged to prosecute my experimental work at my own expense, and to purchase expensive microscopical apparatus, in order not to drop out of sight as an investigator, in a field in which I have gained some distinction. And this notwithstanding the fact that apparatus of the same kind, purchased with government money, has been for two years lying idle at the Army Medical Museum and also in the hands of the National Board of Health.

With the experience and special training I now have and with proper facilities I think I could cultivate this field still more successfully in future and I am sanguine that I could by such labors accomplish more for humanity, for the credit of the Medical Corps of the Army, and for my own reputation than by continuing to perform the routine duties of an Army Surgeon. But I am satisfied that it is useless to continue my attempts in this direction, at a post remote from the centers of learning and without encouragement and material assistance from some source.

I find also that I labor under great difficulties in prosecuting the literary work which I have undertaken on account of my remoteness from libraries and from my publishers. I have recently been obliged to spend much time and money in a trip from San Francisco to Washington made mainly for the purpose of availing myself for a few days of the use of the Library of the Surgeon General's Office. I would further respectfully represent that my Army service has been mostly at remote posts; that I have seen my full share of epidemics and Indian wars; that I have had but one brief tour of duty in the East (1870-1872); that this was broken by three changes of station and an epidemic of yellow fever, that when I accepted a detail as a member of the Havana Yellow Fever Commission I made considerable sacrifices, and enlisted in the cause of scientific research; that my tour of duty with the National Board of Health ought not to have been counted against me as Eastern service as I spent the first summer in Havana and the second in New Orleans and I was only in Washington during the winter months for the purpose of writing my reports and recuperating my strength.

I would further respectfully represent that two positions, which I have felt that I had some claim to, have been filled by the detail of officers junior to me in the service and both of whom had just served a tour of duty in the East. I refer to the position of Curator of the Army Medical Museum and to that of member of the National Board of Health. Either of these details would enable me to pursue my microscopical

and experimental studies and to continue my literary labors under favorable circumstances.

I take the liberty of transmitting herewith a partial list of my contributions to etiology, taken from the bibliography of my work on "Bacteria" to be published shortly. Also a few letters and press notices selected from a large number received which indicate that my efforts to accomplish something for the advancement of science and creditable to the Medical Corps of the Army have not been entirely unsuccessful.

Very respectfully,

Your obedient servant,

GEO. M. STERNBERG,

Major and Surgeon, U. S. Army.

DEPARTMENT OF THE EAST

An order came in April, 1884, transferring Dr. Sternberg to the Department of the East and we were again obliged to dispose of our household belongings at the auction rooms. The government at that time supplied to officers nothing in the way of furniture; the Quartermaster loaned us a kitchen range and some cooking utensils, for the return of which we were responsible. Crossing the continent was no longer a novelty to us, but we took considerable interest in drawing comparisons between conditions on this trip and on those we had previously made. The railroad had made great strides and we found the new dining car service a great improvement on the eating stations of earlier days. Many little towns were springing up near the railroad, marking the advance of civilization across the plains. The immense herds of wild animals that formerly roamed at will were almost annihilated. Whereas in Western Kansas, in the Indian Territory and elsewhere, there were in the sixties such great numbers of buffalo that they blocked the railroads, we now saw only small bands. Immense numbers had been slaughtered for the skins alone, or for the tongues, as these were considered a great delicacy. The work of extermination had been carried forward on such a scale that men had acquired wealth by gathering the bones and horns from the plains for shipment to the East. The buffalo, self-supporting on the grass of the unclaimed prairie, deserved a better fate, more especially as the red man drew largely upon him for subsistence. I recalled the buffalo hunts of the past, in one of which I had participated.

We marveled, too, at the disappearance of the bands of antelope which formerly were to be seen in great numbers. These were for me very interesting animals, very graceful and beautiful. They had once served as pets at frontier cabins and could often be found in small numbers grazing in out of the way places. I have heard men who have hunted the antelope say that they are very inquisitive and guileless and could be induced to come quite near to a sportsman by the "wig-wagging" of a pocket handkerchief. When plentiful they were much hunted because of their delicious meat, by many considered the finest game of the plains.

Space will not permit me to dwell on these scenes, but I cannot resist relating a very touching incident of our journey. One night near midnight as we were rushing along over the mountains on the Central Pacific R. R. a porter came with a gentleman from another car to speak to Dr. Sternberg. The gentleman apologized, saying his wife was very ill, and would the doctor please see her. Dr. Sternberg found her in a very advanced stage of tuberculosis and suffering from uncertain heart action caused by the mountain altitude. She begged and implored him not to let her die, that she must live to see her children once more. Dr. Sternberg was naturally greatly touched by her appeal, and he stayed some time with her to observe the effect of the medicine he had administered and to encourage her. When we arrived at the station where we were obliged to change cars, the invalid chair had failed to arrive for her, although it had been telegraphed for some time before. She became very much excited and said: "If I miss a train I will never see my home and my darling children." Dr. Sternberg said: "You shall not miss a train; I will have the men carry you in a blanket as we sometimes do wounded soldiers on the battle field." This they finally had to do, as the chair did not arrive when the train was ready to start. We took another route from that station, but the husband wrote us later that she reached home just in time to see her children and bid them good-bye.

ATTENDING SURGEON AT BALTIMORE

Shortly after our arrival in the East, Dr. Sternberg was detailed as Attending Surgeon and Examiner of Recruits at Baltimore. A journey of one hour from Washington brought

us to that city. We rented a prettily furnished house and as I was fortunate in my domestic arrangements our new home was most enjoyable. Baltimore is a charming city with excellent libraries, good universities, and a fine school for training in classical music (Peabody Institute), which has served to educate the citizens generally in a demand for a higher class of music. Science is well supported. The Johns Hopkins University is a mecca for students and advanced workers in the sciences, higher education, and medicine.

Dr. Sternberg was pleased with his detail, since it gave him opportunity to do experimental work for the National Board of Health. His orders from the Surgeon-General's Office enabled him to do his Army duty in a satisfactory manner, and still have time and energy to devote to research. I went frequently to the laboratory; he had little or no assistance, and I tried to make myself useful, for with a little instruction I had learned to make bouillon and other bacteriologic media.

As a source of relaxation we attended (in the late afternoons) a course of lectures on French literature by Professor Rabillion, at the Johns Hopkins University. This gifted man made his subjects so entertaining and instructive that we always retained our interest in the French language and literature. I had also accepted an invitation to join a class for the study of the history of art, the principal organizer and instructor of which was Miss Jane Addams, now known throughout our continent for sociologic work as exemplified at Hull House, Chicago.

In 1885 Dr. Sternberg was sent as a delegate from the United States to the International Sanitary Conference in Rome. Friendships were there formed that continued through years of correspondence, and were revived at subsequent international scientific congresses. He translated the transactions, as they were in French. He was made an honorary member of the Royal Academy of Medicine of Rome and a certificate was transmitted to him through the Secretary of War, William C. Endicott.

After his return from the conference in March, 1885, Dr. Sternberg demonstrated for the first time in America at the Johns Hopkins University the living motile plasmodium of malaria discovered by Laveran in 1880. The demonstration was made from freshly drawn blood of a patient suffering

from malarial fever and the ameboid movements of the plasmodium in the interior of the red blood corpuscles were plainly visible. In the next year he introduced the bacillus of typhoid fever to the American medical profession in a paper presented to the Association of American Physicians. Every day of his life at this time was full of scientific work and his brain was very active planning new experiments. He was still engaged on his study of chemical and physical disinfectants. In addition he did a vast amount of professional reading, and kept posted on the best French, German and English medical and scientific literature. He was a frequent contributor to medical and scientific periodicals, and some one has truly said of him that "his writings were pen pictures of his results in his laboratory."

In 1886 we made a trip to Berlin in order that Dr. Sternberg might have the opportunity of knowing personally Professor Koch and perhaps also do some work in Koch's laboratory. On our arrival there we stopped at "The Kaiserhof," a fine large hotel. When the United States consul returned Dr. Sternberg's visit, he was most cordial in his greeting and showed interest in the purpose of our coming. But before leaving he advised us not to remain long at this hotel: "You will be shoveling money out of the window and you can be more comfortable and it will be more convenient for Mrs. Sternberg to be at a Pension." He gave us the address of the widow of an army officer who took a few persons into her pleasant home. We found the house delightfully situated, and were pleased with the refined manner of the Frau. The rooms were so attractive that we arranged at once to board with her, a most fortunate decision for me.

As soon as we had gone through the formality of leaving cards, our friends and new acquaintances began to call, Professor Koch and his first assistant among the earliest. While Dr. Sternberg was working hard in a laboratory, I visited the historic spots and the picture galleries, in fact, everything that made Berlin so attractive. One day about 11 a. m., as we were on the street on which the imperial palace fronts, we saw a very large crowd of people gazing in one direction. They were looking on the distinguished old Emperor William, who

appeared every day at a fixed hour at a certain window to show his interest in the devoted people.

It was during this visit to Berlin that an event occurred to which I have already alluded in connection with the micrococcus of croupous pneumonia. While working in Koch's laboratory, this distinguished investigator naturally referred to Dr. Sternberg's discovery and the fact that he had first found the organism in his own mouth. Dr. Sternberg volunteered to demonstrate the germ from his saliva during his stay. On his return from the laboratory he was somewhat absorbed in thought and when, early the next morning, I asked him the reason for his anxious expression, he confided to me the promise made on the preceding day. "How dreadfully I would feel," he said, "if I have lost that germ in the meantime from my mouth and could not demonstrate a thing that I have written and talked so much about." But when the demonstration was attempted in Dr. Koch's laboratory it was most satisfactory, and a clean proof was recorded in favor of Dr. Sternberg's previous claims.

LOMB PRIZE AWARD

Returning from this trip to Europe, Dr. Sternberg was informed by the health officer of the port of New York that he had won the "Lomb Prize" for his long and faithful work on the practical value of disinfectants. These experiments, begun in 1878 at Walla Walla, Washington, were continued in Washington, D. C., and were completed in the laboratory of the Johns Hopkins University. They were the culmination of studies undertaken as chairman of a committee of the American Public Health Association which had made an appropriation for such investigations. The results were published in full in the transactions of the Association for 1888, and at the request of Mr. Lomb, the essay was revised in 1889. It was subsequently translated into several foreign languages. The scientific standardization of disinfectants and practical measures of disinfection in this country and abroad were largely based on the results obtained in these investigations.

CHAPTER NINE

YELLOW FEVER INVESTIGATIONS

Dr. Sternberg learned that he was expected to do more experimental work in South American countries for the Federal Government and in the early part of 1887 we gave up our Baltimore house in preparation for other duties. Unfortunately, in my judgment at least, the prospective scientific expedition to Brazil and Mexico had for its purpose the verification or refutation of certain alleged discoveries relating to yellow fever. Had it not been for the many demands on Dr. Sternberg to investigate the claims of others to scientific discoveries, he would have been able to concentrate his ability and energy in developing more important work of his own. However, these control experiments were quite important in blazing the trail for future investigations, and as he was at that time better prepared than others for this work, he willingly undertook the task.

At the annual meeting of the American Public Health Association in Washington in 1885, resolutions had been adopted requesting the appointment by the Federal Government of a commission for the investigation of the merits of certain protective inoculations against yellow fever, then practiced in Brazil and Mexico. The appropriation measures failed in Congress until 1887, when, through exertions of Hon. H. C. Davis of Massachusetts and the Louisiana delegation, a fund was made available. The President designated Dr. Sternberg to carry out the investigations. By special order of the War Department he was directed to report to the Secretary of the Treasury, through whom he received from President Cleveland detailed instructions dated April 28, 1887.

Sir:—Referring to the Act providing for . . . investigating the merits of the methods practiced in Mexico and Brazil for preventing yellow fever by inoculation. You are hereby directed under the authority of said act to proceed to Rio de Janeiro, where you will collate the documentary and other evidence of the experiments of Dr. Freire. . . .

First. The source from which the culture supply is secured, which will involve:

(a) The examination of the alleged germ as shown you by those engaged in the business of inoculation.

(b) Verification of the cultivation and process of attenuation adopted.

Second. The methods of the inoculation which you will see verified, if possible, on actual cases.

Third. You will report your opinion on the results attained by the process after a careful examination of the cases which have previously been subjected to inoculation. In forming your judgment of these results you will take into consideration the following points:

(a) Personal characteristics of the patient, age, race, nativity, sex, previous susceptibility.

(b) The period since last inoculated, number of times exposed to contagion.

Having completed this study, you will then proceed to Mexico by the shortest and most practical route and investigate in the same manner the method of inoculation practiced by Dr. Carmona y Valle, and the same method will be observed in conducting the investigation.

While your attention is directed specifically to these points and details with the expectation that they will be carefully kept in view and adopted for your guidance, they are not intended to exclude such additional methods and means of investigation as your judgment may approve in the thorough and careful accomplishment of the purpose of your mission.

In order that every facility may be afforded you for the prosecution of the work, you will make known your errand to the United States Minister at Rio de Janeiro and to the United States Minister at the City of Mexico, respectively, and request them to use their influence in procuring such access to the hospitals, and such other sources of information as you may desire.

It is expected that your investigation will be completed by the 1st of October.

GROVER CLEVELAND.

In connection with these orders it may be well to state that Dr. Sternberg was not consulted in reference to the date of departure, or as to the time he might consider necessary to complete the investigations with which he had been charged. For the information of those who knew him not I beg leave to quote from the preface of his report¹ made in 1889:

1. Annual Report of the Supervising Surgeon-General of the Marine Hospital Service, Washington, 1889, p. 139.

Having for some years been deeply interested in questions relating to the etiology and prophylaxis of infectious diseases, and particularly of yellow fever, the writer was glad to undertake the investigation to which the following report relates, especially as it would give him a long-sought opportunity to supplement observations made in Havana in 1879, by additional experiments made by methods which have been perfected since that date. It must be admitted that the published works of Dr. Freire in Brazil and of Dr. Carmona y Valle in Mexico did not impress him with much confidence as regards the scientific value of the alleged discoveries made by these gentlemen; but while it was evident from their writings that they had fallen into gross errors, the possibility remained that there was a germ of truth in the background. The published statistics of Dr. Freire, especially, were so favorable to his claim that he had discovered a method of prophylaxis by inoculation that a critical examination upon the spot was evidently the only way of ascertaining the exact value which should be accorded to these statistics.

It is always an ungrateful task to criticise the work of those who have earnestly and conscientiously sought to elucidate unsettled questions in science, and especially so when the object in view is the amelioration of human suffering. It would have been extremely gratifying to the writer if he had been able to announce as a result of his investigations that the specific germ of yellow fever has been discovered in Brazil, or in Mexico, and that a reliable method of prophylaxis by inoculation is now successfully practiced in one or the other of these countries. Such a report would be easily written and gladly received by the medical profession in this country and in Europe, but unfortunately I am unable to make a favorable report, and to sustain a negative and show wherein these gentlemen above named have in my opinion been mistaken, calls for an elaborate and extended statement of facts, which I am aware will have but little interest for a majority of the profession; but those who do take the pains to read it will find, I trust, that I have fully sustained the position taken, and for those who in future may undertake to elucidate the unsettled questions relating to the etiology of yellow fever, the report will be found, I believe, a useful beacon, showing the rocks and quicksands in the way of investigators in this field of science, and the absolute importance of proper training and familiarity with modern methods, and with the results of the most recent researches, before entering upon a path in which so many pioneers have gone astray.

JOURNEY TO RIO DE JANEIRO

In compliance with instructions we sailed for Rio de Janeiro on the S.S. *Alliance*, May 4, 1887. Dr. Sternberg had equipped himself with a complete field outfit for bacteriologic investigation. The first port we made was St. Thomas, the island recently purchased from Denmark. Here our ship was coaled by negro women, who chanted a weird song while performing their arduous labor. The passengers amused themselves by tossing small silver coins into the water, for the benefit of negro boys who would dive in the deep clear water and bob up again with the coin between their ivory teeth. On the shore, a cemetery marked the spot where lay buried a number of Moravian ministers, good men who had come in response to the call to preach the doctrine of love and peace. All had succumbed to yellow fever and the white marble slabs told their silent story to those who visited this lonely island. We drove over a good shell road into the country and we there gathered from a tree our first green calabash. Later we became very familiar with this member of the gourd family, so useful to tropical residents for various household containers.

South from St. Thomas we sailed near enough to get a view of several of the neighboring islands, and passed some drifting wreckage. Our next port was Barbadoes, an inviting island, the center of a great sugar industry. We here became acquainted with some beautiful varieties of tropical trees, especially the bread-fruit, which plays quite a part in the sustenance of residents of the tropics. We were offered delicious preserves made from the tamarind and the orange and other tropical fruits, and on every street we could purchase quantities of highly perfumed flowers, for many species which are cultivated in our Southern states here grow in profusion. It was to us a novelty to hear the Negroes speak English with the English accent, a natural occurrence to be sure, since this island is one of the British possessions.

After a long journey, we were greatly relieved when we sighted the island at the mouth of the Amazon River. It was some time before we could realize we were sailing on a river, for the banks of the Amazon were so distant we could not observe even the line of demarcation. The *Alliance* was on

her way to the city of Para, more than 100 miles from the mouth of the river. Dr. Sternberg informed me that I could not go on shore in port, as that city was known to be badly infected at all seasons with yellow fever. Others were also advised that it would be safer for them to remain on the ship, and nearly all the first cabin passengers did so. Two handsome German women in the second cabin went for a stroll through the city and returned quite early. Before we reached Rio both were attacked with a severe form of yellow fever. The ship's surgeon said if they had gone on shore to contract the disease purposely it could not have developed more promptly.

The agents of the ship owners invited a limited number of the cabin passengers, including Dr. Sternberg and myself for a cruise on the Amazon, and an inspection of a rubber depot. We sailed into a bayou and were invited to go ashore to visit a plantation where the blacks were at work gathering rubber juice. A few steps brought us immediately into an almost impenetrable thicket of rubber trees, with vines growing rampant over every shrub and small tree. The black men preceded with machetes and cut away the vines and shrubs to make a path. The process of gathering caoutchouc is an interesting one. With a sharp knife, unlike any I had ever seen, swinging from a wooden handle, an incision is quickly made through the bark of the tree. A small clay cup is made to adhere to the tree just under the incision by a piece of wet, sticky clay, in order to collect the juice. A tree that gives a run of a gill a day is considered a good producer. The flow of the rubber ceases by 11 o'clock in the morning, but the trees are repeatedly tapped on successive days. The juice, which in its natural state resembles condensed milk, is collected in a large calabash and is taken to a cabin for inspissation. A large fire-place and hearth, a wooden paddle with a long handle, and a terra cotta jar from which the bottom has previously been broken, form the equipment for this process. A fire is made on the hearth with nuts gathered in the nearby forest. The long-necked jar is placed over the fire, the rubber is poured gently over the wooden paddle, which is constantly turned over the opening of the jar. On the paddle are coagulated and smoked remnants of the run of the day before. The smoke from the

nut-fire keeps the rubber from becoming acid, and the heat inspissates the juice. When the mass on the paddle amounts to about five pounds it is cut off in a round shape. It is now almost black from the smoking process, and is considered ready to send to market as caoutchouc. The estimated value of the export of this product at that date was given as five millions of dollars per annum.

Our ship carried the mail and hence we were obliged to communicate with many of the cities on our way down the coast of Brazil. Our next stop was at Ceara, the land of distressing droughts. In this region maneoca is largely cultivated and much used for sustenance. Pernambuco, which had been developed under the original Dutch occupation, was chiefly of interest because of its remarkable breakwater by which engineers had secured a permanent harbor. Pernambuco and Bahia are sister capitals of old Brazil, and both are rich in beautiful well shaded streets and parks.

At Bahia a steep incline leads from the harbor to the city proper. I was not aware that a large elevator is provided to lift the passengers to the upper level, and so I missed a visit to this city. For about 200 years Bahia was the seat of the colonial government, and with proper management it should take a prominent place among the cities of the South. It is the original home of the seedless orange, and one finds here rare fruits not seen anywhere else in the world, for they are too delicate when ripe to bear shipping. One of our fellow passengers was a wealthy planter from one of the southern provinces of Brazil. He had seen much of his own country, and Dr. Sternberg found him interesting and well informed. He gave us information in regard to very many local situations, which helped us to gain a knowledge of the country and the people. But, after all, our main interest was in reaching Rio, and Dr. Sternberg was growing somewhat nervous for fear the two cases of yellow fever on board might cause the ship to be quarantined. This would have been a catastrophe as the time specified for his investigation was very limited. Much to our surprise, when we reached Rio de Janeiro the two German women walked with others off the ship. Dr. Stern-

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berg was fearful they would have a relapse, but we afterward learned that they remained several days in a boarding house in Rio awaiting the ship sailing for Buenos Aires.

Rio has a magnificent natural harbor in a protected bay. At the entrance of this wonderful bay, the picturesque column of granite known as the "sugarloaf" is seen towering above the immediate surroundings. On the opposite side in the distance, the "Organ Mountains," sometimes called the "Fingers of God," stand out in bold relief. These mountains consist of a series of steep sharp peaks suggesting the pipes of an organ, from which the name is derived. It is claimed that there is but one other harbor in the world so large as this, and that is at Sidney, New South Wales. In our time, it was currently said that all the war ships of the world could find shelter in the harbor of Rio.

On the following day, Dr. Sternberg presented his credentials to Hon. Thomas J. Jarvis, United States minister and envoy to Brazil. The minister was very courteous and subsequently did everything in his power to further Dr. Sternberg's mission, and to make his stay agreeable. At the suggestion of Mr. Jarvis, we arranged to live at the "Hotel Candido" where he and Mrs. Jarvis were then residing. Soon after our arrival, we were presented at the Court of the Princess Isabella (Regent of the Empire during the absence of her august father, Dom Pedro II).

Dr. Góes, a gentleman who proved of the greatest assistance to Dr. Sternberg during his entire stay in Brazil, was residing with his family at our hotel. He was a man of culture and occupied an honored position in the medical profession of his country as a bacteriologist and a scientific investigator. In Dr. Sternberg's search for yellow fever patients, Dr. Góes accompanied him to the hospitals and aided in collecting blood for microscopic examination and for experimentation.

Dr. Sternberg was soon busily engaged in a laboratory, doing heroic work in order to accomplish the object of his mission. He spent much time in company with some other professional men in visiting "Corticos" to investigate and verify statements in regard to successful inoculations against yellow fever by Dr. Domingos Freire. There was so much work to be done

in solving the problems assigned to him that he worked daily under great pressure and returned home in the evenings perceptibly fatigued.

We visited one morning the height known as "Santa Theresa," one of the most charming environs of Rio. We walked slowly up the height along a zigzag roadway, sheltered by tropical foliage, among which the vanilla vine and orchids were conspicuous. So dense was the shade that one felt barred from leaving the road and entering the almost impenetrable forest. To the right of the roadway is a conduit for water, which is brought down from innumerable springs high up on the mountain. This system of conservation was inaugurated by the Catholic priests in the early days of the city's history. There is a paved conduit for every spring, large or small; the flow from some is so little as to be scarcely perceptible. As each spring increases the volume of water, the conduit becomes larger and larger, until a powerful, gurgling stream is rushing down the mountain through a covered, well ventilated stone aqueduct. This remarkable enterprise of man, vies with beautiful fern trees, orchids, and brilliant birds for the admiration of the tourist. The city proper is built on a narrow plain surrounded by many hills of granite; nowhere near Rio is found a stretch of fields to indicate rural industry or agricultural development. The "Ruo do Ovidor," a narrow street, but nevertheless very lively, is the busiest thoroughfare. Here one sees a constant stream of people, some to make purchases, others to admire the attractive shop windows and the beautiful toilets, so strikingly suggestive of Paris. There is a fashionable restaurant nearby, where the professional men, the bankers and others go at 11 o'clock, or a little later, to enjoy the company of a friend and to take a small cup of black coffee. The Brazilians are a temperate people and know how to preserve health in a hot climate. One should see Rio from the summit of the "Corcovada," a mountain peak situated quite near the city. The ascent is made in comparative comfort by means of a cog railway, although the last few feet are very steep and require climbing to the summit.

There is a delightful resort in a mountain valley to the north of Rio, called Petropolis, at that date the summer residence of the Emperor. When yellow fever is epidemic in Rio,

all those who can afford the expense go up to Petropolis to live in order to escape the danger. It appears that yellow fever does not flourish there and no local focus has ever been established. We now know that this is due to the absence of certain species of mosquitoes which are the real carriers of the disease.

In the meantime, it appeared that the health authorities had ordered that Mrs. Sternberg and the little daughter of Dr. Góes were to be vaccinated. This was considered very necessary as smallpox was increasing rapidly in the city and since Dr. Sternberg and Dr. Góes went every day to the smallpox hospital for pathologic material from yellow fever cases, we were considered in special danger of contracting smallpox. Several days after our vaccination Dr. Góes came to our door quite early in the morning to ask about the condition of my vaccination. His little daughter was very ill, and he expected to find me in the same state, but I had no symptoms of any unusual infection.

DR. FREIRE'S MICRO-ORGANISM AND INOCULATIONS

Dr. Sternberg's scientific work while at Rio can be best related in his own words from the detailed report:¹

Dr. Domingos Freire whose claims I had come especially to investigate, was absent in Europe at the time of my arrival. He had gone to France sometime previously for the purpose of demonstrating his yellow fever germ (*Cryptococcus xanthogenicus*) and calling attention to his method of prophylaxis. I was, however, immediately after my arrival, installed in his laboratory in the school of medicine by the director of the faculty, and received the assistance of his former assistants and pupils, Dr. Chapot Prévost and Dr. Ioaquim Caminhoa.

At my first interview with the prime minister, the Baron Cotegepe, the name of Dr. Góes was mentioned as one who enjoyed the confidence of the Government and who had given much attention to the study of the disease. I found Dr. Góes to be an extremely well-informed physician, a competent microscopist, and one of the pioneers in Brazil in bacteriological studies, especially with reference to yellow fever. He has been prudent enough not to publish prematurely the results of his investigations, but has made extended experimental studies, and has especially devoted himself to the microscopical exam-

1. Report of the Supervising Surgeon-General of the Marine Hospital Service, Washington, 1889, p. 142.

ination of sections of the various organs, made *secundum artem*, and stained with various aniline dyes, a method which Dr. Freire seems to have neglected entirely, for neither he himself after his arrival nor his pupils exhibited to me a single mounted preparation showing his germ in the tissues, or in blood obtained from the victims of yellow fever. Nor did I find in Dr. Freire's laboratory any pathological material preserved in alcohol, for the purpose of histological study. On the contrary, I am indebted to Dr. Góes for material from quite a number of cases, in which he had himself made the autopsy.

. . .

The yellow fever season was about at an end when I arrived in Brazil, but I was fortunate enough to find a few typical cases and to obtain specimens of blood drawn from the finger for study. But, although several of these cases terminated fatally, I did not succeed in obtaining an autopsy.

This was due to the fact that as soon as the diagnosis of yellow fever was established in a case in the wards of the Misericórdia Hospital, or elsewhere in the city, the patient was at once transferred to the smallpox hospital; the Juruja Hospital, designed especially for the reception and isolation of yellow fever patients, having been closed at the end of the epidemic season. I followed two cases to the smallpox hospital, and collected blood from the finger of one, whom I found in a ward with ten or fifteen variola patients, and who ejected "black vomit" in my presence. I was extremely anxious to obtain an autopsy in this case for the purpose of making cultures from blood obtained from the heart and from material from the interior of the organs in which the principal pathological lesions are found, but unfortunately did not receive notice of the man's death until he was already buried. This also occurred in another fatal case, notwithstanding the fact that I made every effort to receive immediate notice of the fatal termination of these cases, and in a fatal case at the Misericórdia Hospital Dr. Góes and myself arrived just ten minutes too late for an autopsy, the body having already been sent to the cemetery, although the man had been dead but an hour.

A considerable portion of my time in Rio was devoted to an investigation of the results of the protective inoculations practiced by Dr. Freire in 1884, 1885 and 1886, and in personally visiting the corticos (tenement courts) in which a large proportion of the inoculations had been made. . . .

Dr. Sternberg then devoted many pages (155-213) to a consideration of the evidence relating to the claims of Dr. Domingos Freire to discovery of the specific cause of yellow

fever and of a method of preventing the disease by inoculation with an attenuated virus. In this analysis Dr. Sternberg demonstrated first, that the micrococcus presented by Dr. Freire as the yellow fever micro-organism did not correspond with descriptions of the *Cryptococcus xanthogenicus*; secondly that no such organism as he had described and was present in the cultures which he furnished to Dr. Sternberg was to be found in the blood or tissues of yellow fever patients.

Having reviewed at length the claim of Dr. Domingos Freire to have discovered a specific yellow fever germ, and to have transmitted this disease to certain lower animals by inoculation, and having arrived at the conclusion that these claims are without scientific foundation, it may be thought that no further demonstration is required in order to show that his protective inoculations are without value. The inoculations practiced are said to have been made with cultures containing the "attenuated" microbe of yellow fever; *a priori* it would appear that if there has been no veritable discovery, and if there is no sufficient evidence that the culture used in making the inoculations contained the specific germ of yellow fever, no value can be attached to such inoculations.

But in order to do full justice Dr. Sternberg first quoted all the evidence from Dr. Freire's published reports, then stated the results of his own investigations; next he presented a thorough analysis of the statistical data in order to establish the real value of the protective inoculations against yellow fever; from all of which he was forced to the conclusion that "there is no satisfactory evidence that Dr. Freire's inoculations have had any prophylactic value."

RETURN FROM RIO DE JANEIRO

While at Rio we received and enjoyed some very agreeable social attention and the Minister and Mrs. Jarvis were exceedingly kind and thoughtful towards us at all times. We also met many distinguished officers of our own Navy, and had enjoyed the social intercourse with so many charming people that we left Rio in deep regret.

We sailed, August 11, intending to take passage at Barbadoes or St. Thomas should we find a ship departing for Vera Cruz, Mex., or for some point in direct communication with that port. Our trip north was made uncomfortable by the

failure of the ice machine and the consequent deterioration of the fresh meats, butter and other perishable provisions. I recall nothing of great interest until we had been several days at sea, when I awoke one night with a severe chill. Dr. Sternberg proceeded to get some hot water in the rubber bag. He soon reentered the state room with the ship surgeon and the stewardess, and prepared a mustard foot-bath, which I knew was much used at that time as a first aid in yellow fever. I was also suffering from aches and pains, further suggestive to me of the disease, although I said nothing of my own apprehension. The following morning there was a general moving on the ship, all the passengers located anywhere near us sought quarters elsewhere to get away from me. Meanwhile I developed a high fever and great thirst, but after another night of discomfort I discovered that the spot on my body where I had been vaccinated was beginning to show life and pained me. I called Dr. Sternberg and informed him of my diagnosis that the vaccine was taking. This proved rather startling information for my husband, who remarked: "That English virus must have been contaminated. There must have been a germ in it that has taken a long time to incubate in your system. The time for the virus of smallpox to take effect has long since expired." I recalled the experience of Dr. Góes in Rio with his daughter's vaccination from the same lot of virus. He said "Yes, but this germ that you have developed must be from another family, it has been so long in developing." It was evidently not a virulent organism, for I recovered promptly and have never since had any reminder of its presence.

Dr. Sternberg during a part of this trip worked a great deal on his report and I helped a little with a card catalogue. Before we reached Barbadoes I said to him one day: "If we were going home how happy we would both be. Why do you want to go to Mexico?" He looked appealingly at me while he replied, "Because I have given so much of my time and strength to the investigation of the cause and spread of yellow fever, that I feel I have exhausted all the legitimate experimental methods that could elucidate the subject. I hope in Mexico I can arrange to make human inoculations. In our own country this is not possible, and I now think that is the only way this problem will ever be solved." Having had an attack of yellow

fever, he considered himself immune and hence experimentation on his own person would have been useless.

When we arrived in the harbor at Barbadoes, the health officer of the port and his wife came out to us in a small boat. We soon learned that every one on board would have to be mustered in order to make sure there were no concealed cases of smallpox or other communicable diseases among us. Preparations were made for this formality by tacking canvas across the deck of the ship, thus dividing it into two compartments. It was quite dark before inspection was begun. The first class passengers were first called, each reporting to the health officer as the name was read from the ship's register. The inspection was very perfunctory, being limited to a casual examination of our faces for evidence of a recent attack of smallpox.

No ship was sailing for Mexico from Barbadoes, although the quarantine would have prevented our getting on board. On arriving at St. Thomas, we found the same rigid quarantine against the ship. No one on board was allowed to land owing to the prevalence of smallpox in Rio at the time of our sailing. Dr. Sternberg was greatly disappointed, for he had confidently expected to sail from St. Thomas for Mexico. He was given no choice, and forced to submit to the quarantine regulations, we proceeded on the ship to New York.

INVESTIGATIONS IN MEXICO

Upon our arrival in New York, Dr. Sternberg made arrangements to proceed at once by rail to Mexico to meet Dr. Carmona y Valle for an investigation of the latter's methods of inoculation and verification of his claims to discovery of the organism of yellow fever. Official orders required that the investigations be complete by October 1, but as it was evident that the remaining time was insufficient to enable Dr. Sternberg to comply with this detail of the instructions, he addressed a letter to the Secretary of the Treasury asking for an extension of twenty days, which was granted.

Immediately on arrival in the city of Mexico, he presented his credentials to the United States minister, Judge Maynard, who introduced him to Sr. Marascal, Secretary of Foreign Affairs, and to General Diaz, President of the Mexican Repub-

lic. From these gentlemen Dr. Sternberg received assurances that the government would do all in its power to further the object of the mission. Sr. Marascal sent a letter to Professor Carmona y Valle, president of the faculty of the National Medical College of Mexico, and another to the governor of the State of Vera Cruz, through whom Dr. Sternberg would be able to obtain the necessary facilities required for the prosecution of his investigations.

Dr. Carmona y Valle at once made an appointment for a visit to his laboratory, favorably located on the top floor of the medical college building, and equipped with all the apparatus required for bacteriologic research, among other things a complete set of Koch's apparatus apparently of recent acquisition and two Zeiss' high power microscopes. At the laboratory Dr. Sternberg met Dr. Carmona y Valle's principal assistant, Dr. Angel Gavino Yglesias, latterly professor of bacteriology in the medical faculty.

Dr. Carmona y Valle exhibited cultures of his yellow fever microbe, mounted preparations of the same stained with the different aniline colors, and sections of liver and kidney stained with hematoxylin and picrocarmine. In his official report Dr. Sternberg said:

These preparations were the work of Dr. Gavino and I take pleasure in complimenting the gentleman upon his technic. I regret to say that I cannot accept Dr. Carmona y Valle's conclusions with reference to the origin and etiological rôle of the micro-organisms which he presented to me as coming from the blood and from the urine of yellow fever patients. I think I will be able to prove to him and to others in my detailed report that they are altogether accidental and without significance, so far as the disease is concerned; that the blood and tissues of yellow fever patients do not contain organisms such as he exhibited to me in the cultures, that these cultures contain a micrococcus and a bacillus, which are specifically different and bear no relation the one to the other, except the accidental one of being associated in his cultures. Therefore, his inference that the spherical organisms—micrococci—are "zoospores" which may develop into bacilli and these again break up into spherical organisms is a mistake; that the movements of these "zoospores" observed by him and exhibited to me, which he says are not arrested by a temperature of 160° C. or by forty-eight hours' exposure to a 1 per cent. solution of mercuric chloride, are molecular and not vital movements;

that the dark-colored granules in his sections of kidney and liver, stained with picrocarmine and haemotoxylin, do not correspond with the organisms contained in his cultures, and in fact are not micro-organisms. While differing radically with the learned professor in all of these particulars, I desire to testify my high appreciation of his laudable effort to apply scientific methods to the study of yellow fever. If he had been situated more favorably for the study of this disease I dare say he would have found out for himself the source of the errors into which I believe he has fallen, but having to depend upon others to collect his material at a distant locality his misfortune has been that the specimens of urine and blood which have served to start his cultures contained extraneous organisms, which bear no relation to the disease which he had undertaken to study.

INVESTIGATIONS AT VERA CRUZ

Dr. Sternberg learned that the inoculations practiced by Dr. Carmona y Valle had for the most part been made in Vera Cruz. It was here that Dr. Sternberg had hoped for an opportunity to make experiments on the human subject, and he proceeded to that city as soon as possible. At his request and by permission of the president of the faculty of medicine (Dr. Carmona) he was accompanied by Dr. Gavino to assist in the researches. After their arrival they established a laboratory in their rooms on the upper floor of the Hotel de Mexico and hastened to put themselves in communication with the physicians in charge of the civil and military hospitals. These gentlemen placed their wards at his service and did everything in their power to further Dr. Sternberg's investigations. In his final report he expressed great obligation to Dr. Daniel Ruiz, director of the civil hospital, for most valuable assistance and for the great interest he took in the experimental researches. Unfortunately for Dr. Sternberg's object, there were very few typical cases of yellow fever in Vera Cruz during the time remaining (three weeks) and he was unable to secure an autopsy in a single undoubted case.

BLOOD INOCULATIONS BY DR. DANIEL RUIZ

Dr. Sternberg was especially interested in the inoculation of blood from yellow fever patients into susceptible persons, and on this phase of the studies he wrote as follows:

If the infectious agent in yellow fever is present in the blood, we would expect that the disease may be transmitted by inoculating a susceptible person with blood drawn from one sick with the disease. Dr. Finlay, of Havana, believes that the disease is commonly transmitted by mosquitoes, which, after filling themselves from a yellow fever patient, transmit the germ by inoculation into susceptible persons. Evidently the most satisfactory and direct way of determining whether the infectious agent is present in the blood would be to make inoculation experiments in susceptible persons. Before going to Brazil I had considered the possibility of making this crucial experiment, and had determined to make it if opportunity offered. When in Vera Cruz I learned that the experiment had already been made in 1885 by Dr. Daniel Ruiz, who is an entire unbeliever in the infectious nature of yellow fever, and had no confidence in the alleged discovery of a yellow fever germ by Dr. Carmona. In order to test, in a practical manner, the truth of his views, he made in 1885, injections of blood and of urine from typical cases of yellow fever into the subcutaneous connective tissue of an "unacclimated" person. The result of these inoculations was negative. At the time of my visit to Vera Cruz he expressed his entire willingness to repeat these experiments in my presence. This was exactly what I desired, and accordingly Dr. Ruiz made three inoculation experiments upon three unacclimated persons in the hospital. Unfortunately, the blood used for two of these individuals was obtained from a case in which the pathological appearance did not fully sustain the diagnosis of yellow fever made during life. . . .

The third inoculation was made from a nonfatal case on the eighth day of sickness, urine still albuminous, skin yellow. Fifty cubic centimeters of blood were drawn from the median vein of this patient by means of a hypodermic syringe, which had been carefully sterilized. This was immediately after injected, subcutaneously, in the deltoid region, into the arm of a man aged forty, from the interior of Mexico, who had been in Vera Cruz only twenty days. The man from whom the blood was drawn was apyretic, and the experiment is open to the criticism that it was perhaps too long after the inception of the malady. I was therefore, anxious to make other experiments before leaving Vera Cruz, but the time fixed by my orders expired without my having had an opportunity to do so.

The physicians attending the civil and military hospitals in Vera Cruz were familiar with Dr. Carmona's claims, but Dr. Sternberg could not learn that any of them had confidence in the protective inoculation, which had been extensively tested in 1885 under their immediate observation. The results then

obtained were not sufficiently encouraging to induce any one to continue the practice in Vera Cruz and Dr. Carmona himself had not made any considerable number of inoculations since.

A great deal of laborious comparative work was accomplished in order to examine and fathom the work of Dr. Carmona y Valle, and Dr. Sternberg's preliminary report contained the following conclusion:

The claims of Dr. Carmona y Valle of Mexico to have discovered the specific cause of yellow fever have no scientific basis, and he has failed to demonstrate the protective value of his proposed methods of prophylaxis.

Dr. Sternberg was by nature generous and kindly, and he fostered a feeling of brotherly interest in the members of his profession, especially those who, like himself, were carrying on research for the benefit of mankind. It was painful for him to refute the claims of those who in their efforts to aid humanity had made mistakes. In order to be quite correct and just, he did an immense amount of corroborative work, often repeating tests that had given rise to the slightest doubt. In reference to his personal disappointment, he said:

No one regrets more than I do that the question of the etiology of yellow fever is not yet solved in a definite manner, but I at least have not to reproach myself with want of diligence or failure to embrace every opportunity for pursuing the research. The difficulties have proved to be much greater than I anticipated at the outset.

If the task before me had been to find an organism in the blood like that in relapsing fever, or anthrax, or an organism in the organs principally involved as in typhoid fever or leprosy, or glanders, or in the intestines as in cholera, the researches I have made could scarcely have failed to be crowned with success. If I have not succeeded in making a positive demonstration which will satisfy the exactions of science, I have at least been able to exclude in a definite manner a majority of the micro-organisms which I have encountered in my culture experiments, as well as those which various other investigators (Domingos Freire of Brazil, Carmona y Valle of Mexico, Carlos Finlay of Havana and Paul Gibier of France) have supposed to be the specific cause of the disease. I shall endeavor to give an exact account of the character of these various micro-organisms, and of the evidence upon which I feel justified in excluding them from consideration from an etiological point of view.

RETURN TO BALTIMORE

After his return from Mexico, Dr. Sternberg received orders from the War Department to report again for duty in Baltimore as attending surgeon and examiner of recruits. This was joyful news for both of us; my husband could arrange the hours of his Army duties and could continue and complete the work of his recent scientific expedition. He would again enjoy the privileges and the facilities of the biologic laboratory at the Johns Hopkins University, where he had previously been made an honorary fellow. Dr. Sternberg always greatly appreciated the value of intimate association with men of sympathetic interests such as Dr. William H. Welch and William T. Councilman; this association brought renewed effort and encouragement. President Gilman and Mrs. Gilman were exceedingly kind and cordial in their greeting to us, and we enjoyed all the pleasure and many of the privileges of the university staff. We also had the good fortune to make or renew the acquaintance of some of the most interesting and influential residents of the city.

Dr. Sternberg had been carefully checking over his work in Brazil and Mexico, and had verified and repeated many of the bacteriologic researches. But he was not fully satisfied and wished to go to Cuba during an epidemic season for further verification and more experimental work. In those days it was not an easy matter to get material for laboratory work as many of the hospitals were very much opposed to postmortem examinations. In order to make certain that there was no invasion of other germs after death, it was necessary that material for biologic examination and experimentation should be obtained within two hours after the patient had succumbed to the disease. During severe epidemics, it was then believed that the body was in such a badly infected condition that nothing should be done in preparation for burial, except to fold the corpse in a sheet, which was saturated with a solution of mercury bichlorid or carbolic acid. Burials were frequently made as early as one or two hours after death. All chances for successful research work were lost forever, unless someone followed the body to the cemetery and obtained the desired material in a clandestine manner. Through the kindness of Dr. Daniel M. Burgess of Havana, Dr. Sternberg had been enabled to do some work with reliable pathologic material.

STUDIES IN HAVANA

April 23, 1888, in response to his own request, Dr. Sternberg received orders to proceed to Havana. These orders were clearly intended to afford him the opportunity for continuing his investigations during the epidemic season at one of the permanent centers of infection, but the time was again limited through misapprehension as to the availability of the appropriation after the end of the fiscal year. He was required to return to his station and submit his report to the President on or before June 25, 1888, but he employed this time most usefully, especially in investigating the claim of Dr. Paul Gibier, a French bacteriologist, who had gone to Cuba in the autumn of 1887 in the expectation of finding the yellow fever microbe of Dr. Freire.

DR. GIBIER'S BACILLUS

Dr. Gibier arrived in Havana in November, 1887, and proceeded to make bacteriologic researches by approved methods. Having convinced himself that neither the micrococcus of Freire, nor any other micro-organism was present in the blood of yellow fever patients, Dr. Gibier turned his attention to the micro-organisms present in the alimentary canal and isolated from the contents of the intestines of one or more cases a liquefying bacillus to which he was inclined to attach special importance. Dr. Gibier kindly placed in my hands a culture of this bacillus upon my arrival in Havana in the spring of 1888, and I have had it in constant cultivation since that time, and have made numerous inoculations into rabbits and guinea pigs which show that it is pathogenic for these animals. But my extended researches give no support to the supposition that it is concerned in the etiology of yellow fever.

This conclusion was based on twenty autopsies made in Havana and in Decatur, Ala., in 1888, and again in Havana in 1889.¹

Not having arrived at any definite conclusion as to the specific cause of the disease under investigation, Dr. Sternberg again requested assignment to Cuba during the epidemic season of 1889, and received orders which enabled him to spend an entire summer in Havana.

1. For further details see Dr. Sternberg's Report on Etiology and Prevention of Yellow Fever, Washington, Government Printing Office, 1890, pp. 167, 177, 178.

YELLOW FEVER GERM OF DR. CARLOS FINLAY

On his earlier visit Dr. Sternberg had taken deep interest in the work of Dr. Carlos Finlay and Dr. Delgado in bacteriology. Dr. Finlay had observed micrococci in groups of four in cultures obtained from mosquitoes, which he allowed to fill with blood from yellow fever patients. He inferred that the micrococci came from the blood of the sick, and that the grouping in fours was a character by which he could distinguish this organism, which he named *Micrococcus tetragenus febris flavae*, upon the supposition that it was concerned in the etiology of yellow fever.

During the winter of 1887-1888, Dr. Finlay had sent Dr. Sternberg a number of mosquito cultures which were found to contain a variety of micro-organisms. Among these the large micrococcus grouped in tetrads was most conspicuous, and it had been isolated and studied in pure culture. Dr. Sternberg found this organism in cultures from the contents of the stomach and intestines of yellow fever cadavers and in one case from the liver. His researches convinced him, however, that it is a very common organism on the surface of the body of patients in the hospitals of Vera Cruz and of Havana. In Brazil in 1887, Dr. Góes obtained it in a culture from blood drawn from the finger of a yellow fever patient. Dr. Sternberg inferred that its presence was accidental and due to contamination of the drop of blood during collection; and this he believed to have been the case when found in Dr. Finlay's culture from blister serum. At all events, in a case of brain disease and one of skin disease, in which Drs. Finlay and Delgado applied blisters and collected serum by their usual method, Dr. Sternberg obtained this micrococcus in Esmarch roll-tubes to which the serum had been added. These cases had not been associated in any way with yellow fever patients, and the blister serum was collected at Dr. Sternberg's suggestion as a control experiment. From this and other experimental data, Dr. Sternberg concluded:

There is no reason to believe that this organism has anything to do with the etiology of yellow fever and its occasional presence in blood drawn from the finger, or in blister serum is due to accidental contamination from the surface of the body or from the atmosphere.

Dr. Sternberg in reference to this matter also wrote:

My friend, Dr. Finlay, is a most enthusiastic and industrious investigator, but like many other pioneers in bacteriological research at a distance from centers where modern exact methods had their origin, at the time of making his first publications he was not familiar with methods of isolating and differentiating micro-organisms, and he fell into the usual and almost inevitable errors of inference as to various micro-organisms encountered by him in his earlier researches. He has since made himself familiar with the methods referred to and no longer insists upon the etiological relations of this micrococcus to the disease under consideration — namely yellow fever.

NEW METHOD OF TREATING YELLOW FEVER

Dr. Sternberg studied all factors related to yellow fever, such as climatic influences, the origin of epidemics and the surroundings, in fact everything relating to the cause and prevention of this frightful plague. His intimate association with the disease had convinced him that no medical treatment could be regarded curative and only a few remedies afforded alleviation, hence he considered careful nursing and alimentation of prime importance. His researches in Havana in 1888 led him to think it very probable that in yellow fever as in cholera, the specific micro-organism causing the disease is located in the alimentary canal, and he therefore made an attempt to formulate a method of treatment in accordance with this view of the etiology and pathology of the disease. In support of this he said:

The intensely acid condition of the urine and the vomited matter, in fact, I have usually found the contents of the intestine more or less acid, has led me to think that a very decidedly alkaline treatment might be beneficial, and in view of the probability that the specific infectious agent is located in the alimentary canal, I have combined with it the agent which is known to restrict the development of micro-organisms when present in very minute quantities. The formula suggested was as follows: Sodium bicarbonate, 10 grams; mercury bichlorid, 2 centigrams; water, one quart; three tablespoonfuls to be given ice cold every hour.

A letter from Dr. D. M. Burgess, sanitary inspector of Havana, gave an account of the results up to a fixed date.

Ten cases (six severe ones) have been treated at Garcini by your alkaline and bichlorid method, and all have recovered; none subjected to that method have died, three were treated successfully in another hospital here. Four are today receiving the treatment at Garcini, and about an equal number at each of two other institutions.¹

Among sixty-five white patients treated at Decatur, Ala., by other methods the mortality rate was 40 per cent., and among twenty-five colored patients 20 per cent., whereas under the alkaline and bichlorid treatment not a single death occurred out of thirty-two cases among the colored population, and the mortality rate among the whites was reduced to 12.5 per cent. Dr. Sollace Mitchell of Jacksonville, Fla., wrote to Dr. Sternberg, Sept. 9, 1889:

I treated in all 216 cases. I did not begin the use of the bichlorid until I had treated some thirty-five or forty by other methods, and when the bichlorid was begun, only every fourth patient was put upon it, then every other patient, and toward the last almost all patients were put upon it. The bichlorid and alkaline treatment gave the best results by all odds.

Dr. Mitchell's list included 106 cases with five deaths, a mortality rate of 4.7 per cent.; seventy-nine of these cases and all of the deaths were among white patients, a mortality rate of 6.3 per cent., twenty-seven patients were colored, with no deaths. The mortality among the white population considered separately, was estimated at from 22 to 25 per cent.

METHODS OF RESEARCH

The investigations conducted in the city of Havana in the summer of 1888 and 1889, at Decatur, Ala., in the autumn of 1888, and pathologic research in the laboratories of the Johns Hopkins University during the intervals between visits to infected localities, formed the basis of Dr. Sternberg's final report. The bacteriologic studies were made with material from forty-three yellow fever cadavers, from "black vomit" and from feces of patients in various stages of the disease. Eighteen cadavers in which death occurred from diseases other than yellow fever were used as controls. The reports give clear statements of facts, and an outline of the procedure. He

1. See p. 85 of Dr. Sternberg's Report, also *Therap. Gaz.* (Aug. 15) 1888; (May 15) 1889.

describes (1) the source of material; (2) the methods of collecting material; (3) the methods of research: (a) the direct examination of smear preparations from the blood and tissues for micro-organisms, (b) aerobic cultures, (c) anaerobic cultures, (d) examinations of tissues kept for forty-eight hours in antiseptic wrapping, (e) experiments on animals, (f) examination of tissues preserved in alcohol, and (g) photomicrographs of micro-organisms encountered.

The exhaustive investigations on which his final reports were based are indicated in an outline of the technical procedures in the research.

EXAMINATION OF SMEAR PREPARATIONS

Referring to the direct examination of smear preparations from the blood and tissues of all of his autopsies he wrote on page 104:

Usually I have stained these preparations with an aqueous solution of fuchsin, or with Loeffler's solution of methylene blue . . . and I feel very confident that with my 1/18 homogeneous oil immersion objective of Zeiss, the Abbe condenser and a fuchsin-stained smear preparation from the blood, liver or kidney, any micro-organism of this class which might be present should be seen.

His preparations of blood from the heart did not show the presence of micro-organisms, even in cases in which he obtained them by the culture method; as a rule the results of such cultures were negative, but in certain cases colonies of *Bacterium coli commune* and occasionally of other bacilli developed.

My smear preparations made from material obtained from the stomach and intestine have always shown the abundant presence of micro-organisms. . . . There is no single one to fix the attention as being peculiar to yellow fever, or so constantly and abundantly present as to give ground to the belief that it is concerned in the etiology of this disease.

AEROBIC CULTURES

Aerobic cultures from blood from one of the cavities of the heart in the majority of cases gave a negative result, but in a certain proportion of the cases colonies developed in Esmarch roll-tubes to which one or more drops of blood had been added.

A summary of these results showed that he obtained micro-organisms in his aerobic cultures in blood from the heart four times in nineteen cases ; in the liver and kidney, or both, thirteen times in forty-three cases. He stated :

It will be noticed that the micro-organisms most frequently encountered were non-liquefying, my bacillus "A" and bacillus "X". We are therefore able to assert in the most positive manner that the blood and tissues of yellow fever cadavers do not contain aerobic liquefying organisms unless by rare exceptions and can definitely exclude the micrococcus of Freire and the "tetragnus" of Finlay, from consideration as possible agents in the etiology of this disease, as both of these grow readily in the culture medium used in these investigations and both liquefy gelatin.

This fact seemed to exclude from consideration the supposition that yellow fever is due to the presence in the alimentary canal of a liquefying bacillus, as is the case in cholera.

We might be satisfied with this general statement but for the fact that Dr. Paul Gibier, during his visit to Havana in 1888 encountered a liquefying bacillus which he supposed for a time at least to be the specific microbe of the disease. In view of Dr. Gibier's publication referring to this bacillus, I have given special attention to a search for liquefying colonies in the dejecta. As stated no liquefying colonies have made their appearance in a considerable portion of the cases, but in a few exceptional cases the liquefying colonies have been very numerous. . . . These experiments were repeated for a control experiment at Decatur, Ala., October, 1888, which gave numerous liquefying colonies ; colonies both from the stomach and the intestine, and the liquefying organism proved to be the staphylococcus pyogenes aureus. . . . After further experimental work this conclusion is given in regard to the claim of Dr. Gibier's bacillus (Sternberg's bacillus "G"). It has been present in the intestine of a few cases, but that it has been absent in a much greater number, and when present has not been abundant as compared with the nonliquefying organisms. The inference is that its presence is accidental and that it bears no etiological relation to the disease, and in view of the facts developed by my culture experiments the broad statement seems to be justified *that yellow fever is not due to a liquefying aerobic bacillus.*

ANAEROBIC CULTURES

An account of the various micro-organisms which Dr. Sternberg isolated by this method was given.

The general results so far as investigations on blood and tissue are concerned are similar to that obtained in my aerobic cultures. That is, various micro-organisms have been encountered in the series of cases in which this method has been applied, but no one of them has been constant, and in considerable proportion of the cases the result has been entirely negative. Some of the micro-organisms isolated in my anaerobic cultures are identical with those obtained in aerobic cultures from the same source; for my bacillus "A" and "X", and other bacilli associated with them in the intestine, are facultative anaerobics and grow either in the presence, or the absence of oxygen.

EXAMINATION OF TISSUES IN ANTISEPTIC WRAPPING

This led to uniformly negative results, as is clearly apparent from Dr. Sternberg's writings:

A microscopical examination of stained smear preparations of the liver or kidney shows that a large number of micro-organisms are present.

The one which I found most constantly and abundantly in yellow-fever tissues preserved in this way was a large anaerobic bacillus — my bacillus "N", which I now call *Bacillus cadaverinus*. Having also found this several times in my smear preparations from fresh liver tissue, and finding it to be very common in the contents of the intestine, I hoped for a time, that it might turn out to be the specific agent in the disease under investigation. But before leaving Havana, I had found what appeared to be the same bacillus in a piece of liver, which I obtained from a case of tuberculosis; and since my return to Baltimore I have found it in other comparative autopsies; so that I now feel compelled to exclude it from consideration as having any etiological relation to yellow fever.

RESULTS OF EXPERIMENTS ON ANIMALS

Dr. Sternberg in 1879 at Havana exposed a number of guinea-pigs on an infected ship during the hottest part of the year for a period of forty-eight hours; none of the animals contracted yellow fever.

Dr. Freire in 1885 made inoculations in guinea-pigs of blood and from "black vomit" in which death followed the inoculation and in every one of which the assumption is made that the animals succumbed to yellow fever. But his summary statement of these experiments presents some points of interest. Thus we find that one animal died at the end of a few hours,

while one lived for 30 days. Yet death in both of these extreme cases is ascribed to yellow fever, resulting from the inoculation practiced.

Dr. Sternberg made nearly 100 inoculation experiments in order to verify Dr. Freire's claim, but failed to produce the disease. He found that the blood and liver tissues were not always pathogenic for guinea-pigs or rabbits,

but that in exceptional cases in which the large anaerobic bacillus "N" is present, death may occur very promptly. We must therefore conclude that the death of guinea-pigs inoculated by Dr. Freire during the epidemic season resulted not from yellow fever, but from inoculation with some pathogenic organism, which was abundant during the summer months, and consequently was present in his cultures, or from accidental inoculation through the wound made by him in his experiments.

A large number of experiments and control experiments were also undertaken to test the infectiousness of the contents of the stomach and intestine, and while some of the inoculations proved virulent and even fatal to guinea pigs, he was unable to demonstrate that any one of the numerous micro-organisms encountered was the specific cause of yellow fever.

EXAMINATION OF TISSUES PRESERVED IN ALCOHOL

There were many days spent in painstaking search for micro-organisms in tissues obtained postmortem and preserved in alcohol.

In all infectious diseases which have been proved to be due to the presence of a parasitic micro-organism in the blood, this organism may be demonstrated in properly stained thin sections of the tissues. In such sections we often obtain cross sections of small blood vessels in which the blood corpuscles are in situ, and in which a stained micro-organism if present would be very apparent. . . . Moreover in certain infectious diseases in which a parasitic micro-organism has been proved to be the essential etiological factor this organism is not found as a rule in the general blood current, but is present in the tissues, especially implicated in the morbid process; *e. g.* in typhoid fever in the spleen and intestinal glands, in tuberculosis in the tubercular nodules in the lungs and elsewhere. Failure to find a parasitic organism in blood drawn from the finger is therefore not satisfactory evidence of the absence of a specific germ from the tissues of the organs involved. As in yellow fever the liver and kidneys give evidence of pathological changes resulting from this disease, I have naturally

given special attention to these organs in the researches I have made. The Havana commission in 1879 made numerous sections of material preserved in alcohol from eighteen cases, and a careful examination of these sections failed to reveal the presence of any micro-organism; but as more satisfactory methods of staining have since been devised, I have not considered the work done at that time as conclusive in this regard. I therefore wrote to my friend, Dr. Daniel M. Burgess of Havana, sometime in the summer of 1884, requesting him to obtain for me small pieces of liver, kidney and stomach from one or more typical cases of yellow fever. I made it an essential condition that the autopsies should be made within an hour, or, at the outside, two hours after death, so that there might be no question of postmortem changes. Small pieces of the organs named were to be put up at once into a large quantity of strong alcohol. The specimen arrived in good condition, and, upon microscopic examination, the liver and kidneys showed the pathological changes constantly found in the disease in question.

During the winter of 1884-85 I mounted numerous thin sections from material, stained with various aniline colors. In none of these did I find any micro-organisms, except upon the surface of the mucous membrane, in sections of the stomach where various organisms — bacilli and micrococci — were to be seen in properly stained sections. . . .

In the autumn of 1885, during a visit to Dr. Koch's laboratory in Berlin, I had an opportunity to avail myself of the suggestions and valuable assistance of the master of bacteriology and I again studied the material which Dr. Burgess had sent me from Havana by the various methods of staining considered to be most useful in such research. At the request of Dr. Koch I was assisted in this research by Dr. Carl Seitz, who was at that time engaged upon his studies of typhoid fever, and was an expert in staining and mounting thin sections of the tissues. Dr. Seitz and myself examined numerous sections of liver and kidney stained by various methods, with entirely negative results, so far as the presence of micro-organisms was concerned.

After my return to Baltimore in 1886 I again made numerous sections from the same material and stained with Loeffler's alkaline solution of methylene blue, which we had also used in Dr. Koch's laboratory, and with other aniline colors, but without any better success. Desiring to repeat these researches upon fresh material, I wrote to my friend, Dr. Burgess, during my stay at Rio (June and July, 1887) requesting him again to collect pathological material for me from at least four cases of yellow fever, so that after my return to Baltimore I might continue these investigations. As before, this material was to

be obtained as soon as possible after death, that autopsies should be made within an hour, or, at the outside, two hours after death and to be put at once into strong alcohol.

About the first of December I received from Dr. Burgess the desired material in good condition.

I have made a large number of very thin sections, which I have studied and stained by various methods of staining and with objectives of high power, the one-eighteenth and the one-twelfth inch homogeneous oil immersion of Zeiss. . . .

The result of this research has again been negative so far as the general presence of any particular micro-organism in the material examined is concerned.

PHOTOMICROGRAPHS

Dr. Sternberg was very proficient in the preparation of photomicrographs, which process he had successfully employed in his numerous bacteriologic demonstrations and later in illustrations for his textbook of bacteriology. On this phase of his investigation he reports:

I have made photomicrographs of the micro-organisms encountered in my researches both for the purpose of illustrating my report and as the best method of studying their morphology and comparing one with another. All bacteriologists now recognize that as a rule it is impossible to identify the different species of bacteria by their morphological characters. There are a number of distinct species of micrococci and of bacilli, which resemble each other so closely in form and dimensions, that it is impossible for experts to decide from a microscopical examination alone whether they are identical or not. This can only be determined by other characters, such as growth in various culture media, pathogenic power, etc. But, on the other hand constant morphological differences enables us to differentiate micro-organisms of this class and such differences are shown in well made photomicrographs, which enable us promptly to recognize differences of form, of dimensions and of arrangements. Measurements are also made with great ease when such photomicrographs have been made with a standard of amplification.

CONCLUSIONS

Dr Sternberg published these researches in his report on the "Etiology and Prevention of Yellow Fever" in 1890 by order of the Secretary of the Treasury under the Act of Congress approved March 3, 1887. The report covers 271 pages, with 21 plates and reproductions of photomicrographs, illustrating

the numerous micro-organisms, and was accompanied by 180 microscopic slides, which were deposited in the Army Medical Museum. Dr. Sternberg formulated the following conclusions :

The experimental data recorded in this report show that the specific infectious agent in yellow fever has not been demonstrated. The most approved bacteriological methods fail to demonstrate the constant presence of any particular micro-organism in the blood and tissues of yellow fever cadavers.

Blood, urine and crushed liver tissue obtained from a recent autopsy are not pathogenic, in moderate amount, for rabbits or guinea pigs. Liver tissue preserved in an antiseptic wrapping at a temperature of 28 to 30 C. for forty-eight hours is very pathogenic for guinea pigs when injected subcutaneously. This pathogenic power appears to be due to the micro-organisms present and to the toxic products developed as a result of their growth. It is not peculiar to yellow fever, inasmuch as material preserved in the same way at comparative autopsies, in which death resulted from accident or other diseases, has given a similar result.

Having failed to demonstrate the presence of a specific germ in the blood and tissues it seems probable that it is to be found in the alimentary canal, as in cholera. But the extended researches made and recorded in the present report show that the contents of the intestine of yellow fever cases contain a great variety of bacilli and not a nearly pure culture of a single species, as is the case in recent and typical cases of cholera.

Dr. Sternberg had doubtless hoped that his researches might lead to the discovery of the yellow fever germ, a discovery alike creditable to American science and useful as a basis for preventive and curative measures in this pestilential malady. While the result was a great disappointment to him, he realized that his work had not been in vain and would be of great value in guiding future investigators in this field of research. This hope was attained in his lifetime. His thorough and painstaking work is not disparaged even now, for although it was long known that the infectious agent is transmitted through the sting of a mosquito, and the search had narrowed down to the body of this insect, the causative organism (*Leptospira icteroides*) has only recently been isolated by Dr. Hideyo Noguchi, member of a commission which was sent by the Rockefeller Foundation to South America for the study of foci of yellow fever.

Dr. Sternberg was prepared for such a possibility as shown by a paragraph in a paper read at the quarantine conference held in Montgomery, Ala., in March, 1889, just before his last research work in Havana.

I may say before going any further that my faith in a living infectious agent as the specific cause of yellow fever is by no means diminished by my failure thus far to demonstrate the exact form and nature of this hypothetical "germ."

The present state of knowledge with reference to the etiology of infectious diseases in general, and well known facts relating to the origin and spread of yellow fever epidemics fully justify such a belief. But yellow fever is by no means the only infectious disease in which satisfactory evidence of the existence of a living infectious agent is still wanting. In the eruptive fevers generally no demonstration has been made of the specific etiological agent—at least none which has been accepted by competent pathologists and bacteriologists. The same is true of hydrophobia, in which disease we are able to say with confidence the infectious agent is present in the brain and spinal cord of animals which succumb to rabies; this infectious agent is destroyed by a temperature which is fatal to known pathogenic organisms (65 C.), and by various germicide agents, yet all efforts to cultivate it or to demonstrate its presence in the infectious material by staining processes and microscopical examination have thus far been unsuccessful.

Dr. Sternberg's time was fully occupied during these investigations as must be evident from the thorough study of the various micro-organisms isolated by him, his numerous culture experiments and the preparation of 180 microscopic slides of his pathologic material. While in Baltimore he did most of his pathologic work and not only completed the report referred to in the foregoing, but also his first report on yellow fever work in Cuba, Brazil, Mexico and Decatur, Ala.¹ In addition he was subject to interruptions by his official duties as attending surgeon and examiner of recruits, and as a member of boards for the examination of candidates for admission into the Medical Corps. Years have passed since Dr. Sternberg's pioneer research work was done and a new generation has arrived on the stage of life, for whom he paved the way to final success by his exclusion of numerous suspected organisms. If I have succeeded in impressing the younger members of the profes-

1. See Report of the Supervising Surgeon-General of the United States Marine Hospital Service, 1889, p. 137-233.

sion with the zeal, thoroughness and accuracy displayed by Dr. Sternberg in his efforts to unravel the mystery of yellow fever, I shall feel amply repaid. It was given to him to know at least how to combat one of the greatest scourges of the past, and it has recently fallen to the lot of an investigator from an American institute of medical research (Dr. Hideyo Noguchi), working in conjunction with one of the successors of General Sternberg in the office of Surgeon-General (Gen. William C. Gorgas) to demonstrate the causative agent of the disease. I am informed that this discovery was made possible by the introduction of dark field illumination and improved culture methods.

CHAPTER TEN

MEDICAL PURVEYOR AT SAN FRANCISCO

A vacancy in the grade of Lieutenant Colonel in the Medical Corps occurred in October, 1890. Dr. Sternberg had been the ranking Major in the corps for some time and in line for promotion to the grade of Lieutenant Colonel. With this promotion we knew would come an order for a change of station, a fact which caused us no little regret. The work connected with his duty in the Army would probably interfere with his experiments in bacteriology. He had just completed a lengthy report giving the results of his investigations of yellow fever, but there still remained certain experimental work which he wished to do. The order detailing Dr. Sternberg as medical purveyor at San Francisco was issued October 3, 1890. The duties required of him in this capacity were of a strictly business character, and it was very painful for him to give up his researches. When professional friends came to say good-bye, I heard him speak of the topics he had long wished to take up and he was already estimating the possibility of doing some of this work in addition to his duties as medical purveyor.

The tour of duty in San Francisco was for Dr. Sternberg a sudden and complete change of mental occupation. Still, with all the exactions of a large business to transact and keep in perfect running order, he found time to do a great deal of reading in modern science and to write on his favorite subjects. He was particularly interested in bacteriologic research by experts in other countries so that he might bring his *Manual of Bacteriology* fully up to date. As a student of preventive medicine he paid special attention to the eradication of preventable disease, and for this reason he felt it his duty to accept invitations to address professional and public audiences on topics which instructed the physicians and the public in the application of scientific methods to the cause of humanity. Most of his lectures were illustrated with lantern slides of photomicrographs made by himself. He spoke in a pleasant tone of voice, knew his subject perfectly and made his points clear. His popular subjects related largely to the causes and

prevention of tuberculosis, typhoid fever, malaria, diphtheria, scarlet fever and infection and susceptibility to infection. In some cities he gave expert information in regard to the hygiene of water supply and drainage, and advised on methods for the removal of unsanitary conditions. In matters of sanitation, he considered public education more effective than legislation.

So deeply engrossed was he with his official business and scientific pursuits, that he scarcely gave himself an hour's leisure. It devolved upon me to plan diversion for his mental and physical welfare. His interest in botany gave me excuse to suggest short trips to Monterey and other coastal resorts, to the beautiful Santa Clara Valley and to San Jose. Many times we drove to Golden Gate Park, a magnificently cultivated tract of one thousand acres fronting the ocean. Its conservatories have many exotic plants, rare begonias and orchids, while groves of bamboo and of Australian trees give the impression of residence in the subtropics.

PUBLICATION OF MANUAL OF BACTERIOLOGY

In addition to his regular duties as medical purveyor, Dr. Sternberg served as member of a board to examine officers of the Corps of Engineers, with a view to determining their fitness for promotion, and on surveys for ascertaining and fixing the responsibility for any loss or damage of quartermasters' stores and garrison equipage. But his most exacting and painstaking labor was devoted to the completion of his monumental work on bacteriology. This volume covered 900 pages, and gave an extensive account and systematic classification of micro-organisms, describing nearly 500 species, including 158 pathogenic varieties. Many of the illustrations were from photomicrographs prepared by Dr. Sternberg. The treatise was for many years the leading manual for teachers and physicians, and an instructive textbook for students of medicine. Dr. Walter Reed, who later attained fame for scientific work in the same field, commented on the book in the following letter:

Headquarters Department of Dakota,
St. Paul, Minn., March 28, 1893.

Dear Doctor:

Please accept my heartiest thanks for the cultures which arrived in good shape, a few days ago. I should be very glad to give more of my time to bacteriology, but, alas, my dear

doctor, when most interested I must stop for practical things, so that I can only do the merest "dabbling." I have your new work, which was sent to me on special requisition. How an Army medical officer, in the midst of daily routine work, could have written so excellent and so exhaustive a work, I can't understand. Besides reflecting the greatest credit on our Corps, it must always stand as a monument to your energy and ability.

Again thanking you for your kindness, I remain,

Sincerely yours,

WALTER REED.

ATTENDING SURGEON AT NEW YORK

Dr. Sternberg was relieved from duty in the purveying depot of San Francisco, Feb. 2, 1892, by orders which assigned him to New York as attending surgeon and examiner of recruits. We preferred to go East by the Southern Pacific R. R., to give Dr. Sternberg opportunity to visit a sister living in Los Angeles. On arriving in New York we engaged accommodations well uptown, quite near the Windsor Hotel. The house was large and well located on a crosstown street. Dr. Sternberg's duty obliged him to be at the Army Building (foot of Broadway) at an early hour in the morning, and in order to accomplish this he journeyed back and forth on the elevated road. The daily trips on crowded and illventilated cars proved very fatiguing and we therefore located at the St. George Hotel in Brooklyn, very near the foot of Broadway. The change seemed all the more desirable as we had friends living in Brooklyn, and a number of Army and Navy officers were stopping at the same hotel.

Dr. Sternberg had been for some time the director by correspondence of the Hoagland laboratory for bacteriologic research. This laboratory was built and endowed by a wealthy citizen of Brooklyn, Dr. C. N. Hoagland, and Dr. E. H. Wilson was in active charge. It was proposed by Dr. Wilson that I should do some laboratory work and act as chaperon for a large class of lady students from the Pratt Institute contemplating a course at the laboratory. The class after learning general laboratory technic and how to make culture media, studied the bacteriology of drinking water, of the milk supply of the city, made gelatin cultures from the air, and did various routine procedures. No pathogenic or disease germs were given them for cultivation or isolation. I had learned earlier how to

make cultures, and how to use the microscope with high power lenses, and was fairly familiar with other details.

While we were examining the growths from samples of the drinking water, I isolated an organism that gave me considerable uneasiness. It was new to me; I made several cultures because it acted so strangely that I thought I must have contaminated my culture from my needle or some unknown source. On the first day the organism looked very much like the bacillus of tuberculosis, by the second day it had lost all resemblance. After trying hard to solve my problem, I spoke of it to Dr. Sternberg. One day he walked over to the laboratory with me. I again prepared my slide and placed it under the microscope. Dr. Sternberg noted its resemblance to the tubercle bacillus, but cautioned against mentioning it lest all Brooklyn be wild to think that the water supply was contaminated. But when he saw the slide I prepared on the following morning, he concluded that my "discovery" was an interesting specimen of protozoa not previously described. I had the privilege of naming it after Dr. Hoagland, the generous founder of the laboratory. Years after I was informed by Dr. Wilson that they still carried a culture of my "find" at the laboratory.

CONSULTANT IN CHOLERA QUARANTINE

In September, 1892, because of the prevalence of an epidemic of cholera in Hamburg, a vessel bound for New York was detained at the quarantine station. Prompt steps had to be taken to prevent the spread of the disease in the United States, and Dr. Sternberg (primarily at the request of Mr. Ohr, president of the chamber of commerce), was called into consultation, which action was approved by the following official communication from the Surgeon-General's office.

Lieut. Colonel George M. Sternberg,
Attending Surgeon and Examiner of Recruits,
New York City, N. Y.

Sir:

I am directed by the Surgeon General to say that the Secretary of War has approved the request of Allen McLane Hamilton, M.D., Secretary of the Special Cholera Committee, Chamber of Commerce, New York City, N. Y., for your temporary detachment for service with Dr. Jenkins, Health Officer at the

Port of New York, and the fact was communicated to you by telegraph this morning.

The Surgeon General desires that you will leave notice at your office in the City of New York, that ordinary calls for professional service from the officers on duty in the city will be attended to by Dr. A. B. Townsend, under the provisions of G. O. No. 75, A.G.O. Sept. 2, 1881. Upon your return to the city you will please have Dr. Townsend's account made up and forwarded to this office for payment.

Very respectfully,

CHAS. R. GREENLEAF,
Deputy Surgeon General, U. S. Army.

This detail required Dr. Sternberg to be on duty at the quarantine station on Staten Island, and he accepted the kind invitation of Dr. Jenkins to be his guest while engaged in this work. Dr. Sternberg was at that time considered an authority on cholera; he had learned much from experience in combating a severe epidemic at Fort Harker, Kan., in 1867, and had devoted much time in the laboratory to the study of the causative agent and methods of sterilization by physical and chemical means.

At the request of the health officer of the port, Dr. Sternberg made exhaustive tests of the efficacy of disinfection methods employed at Hoffman's Island, the results of which were summarized in published articles.¹

As a singular triumph of American preventive medicine it may be pointed out that although cholera affected over 17,000 persons and caused 8,605 deaths at Hamburg, and had been brought to our very shores, not a single case developed in this country, nor has it ever gained a foothold during the succeeding years.

After Dr. Sternberg's relief from special detail at the quarantine station he received assignments to duty on various special boards. The first was for an examination of an officer with a view to his selection for transfer to the Ordnance Department. Shortly after this, another order came to serve on a board to investigate the sanitary condition of Madison

1. Disinfection at Quarantine Stations, Especially Against Cholera, *New York M. J.* 57:57, 1893; How Can We Prevent Cholera? *Med.-Leg. J.* 11:1, 1893; The Biological Characters of the Cholera Spirillum, *Spirillum Cholerae Asiaticae* (Comma Bacillus of Koch) and Disinfection in Cholera, *Med. Rec.* 42:387, 1892.

Barracks in connection with an epidemic of typhoid fever, and to report to the Secretary of War what measures were necessary to establish sanitary conditions specially in respect to the water supply. This was scarcely accomplished, when he was detailed on a board to meet at New York City for examination of such officers as might be ordered before it with a view to determining their fitness for promotion.

In the meantime, we heard of the prospective retirement of Surg.-Gen. Charles Sutherland. All the senior officers of the Medical Corps were naturally interested to know who was to be the new Surgeon-General of the Army. Dr. Sternberg had learned that other officers of the Corps, junior to him, had forwarded papers and stated reasons for their selection for the office. He therefore submitted his own testimonials and presented his claims, and we were naturally anxiously awaiting the results.

CHAPTER ELEVEN

APPOINTMENT AS SURGEON-GENERAL

May 30, 1893, Dr. Sternberg received a telegram telling him he had been appointed by the President as Surgeon-General of the Army. He came at once to Brooklyn, but not finding me at home he hurried to the Hoagland laboratory. It was an unusual hour for his return and I suspected what brought him—for I had just received a telegram giving me the same information. He stepped quickly to me and said: "Put up your microscope, my dear, for I have something to tell you that will cause you to be happy." He was very silent on the way home and when we were alone he looked seriously into my face and said: "I do not know whether I am happy or not. I face great responsibilities and it is not an easy matter to satisfy everybody, and when I make one man happy by recognizing his ability there will be many others disappointed and disgruntled, so I scarcely know if I am to be congratulated or not. But I know the Medical Corps and am proud of the Corps. I have no family and I shall consider the medical officers my family and will give every man a chance. I shall endeavor to promote a truly scientific spirit in the Corps and where I recognize special ability, I will do all I can to aid the respective officer to achieve success."

He adhered strictly to this resolution throughout his entire administration, and his policy resulted in stimulating not only interest and enthusiasm on the part of individual members of the Medical Corps in scientific work, but also in the professional development of many members of the Corps, of whom we are all justly proud. These men in my humble opinion owe their success largely to the inspiration and encouragement received from General Sternberg, who was himself thoroughly equipped for modern scientific work. In this opinion I am amply supported by the judgment of former Secretary of War, Hon. Elihu Root, and by the following quotation:

In accordance with the liberal policies of General Sternberg's administration, Major Walter Reed [1851-1903] was sent to pursue advanced studies in pathology and bacteriology under Professor Welch at the Johns Hopkins University Hospital and

in Welch's laboratory made an important investigation of the lymphoid nodules of the liver in typhoid fever (1895). In 1900 Reed was detailed as the head of a board, which included James Carroll, Aristides Agramonte and Jesse W. Lazear to study yellow fever in Cuba.¹

As this important work of the Yellow Fever Commission was also intimately connected with the life and work of General Sternberg, it will be considered in the regular chronologic order.

General Sternberg proceeded at once to Washington to assume his new duties. It was necessary that I should superintend the packing and shipping of our household effects, and some of our own laboratory apparatus. General Sternberg selected a nice apartment of four rooms at the Richmond Hotel, as we wished to have time to choose our new home. In the autumn we purchased a new house on Sixteenth Street, four squares from the office of the Surgeon-General in the War Department. For the first time in four years we had the opportunity of having all our household belongings together, and we had a new sensation as we hung our Indian trophies and curios in our own halls.

ESTABLISHMENT OF THE ARMY MEDICAL SCHOOL

Very soon after taking over the office of Surgeon-General Dr. Sternberg recommended the establishment of the Army Medical School in Washington, D. C., which was accomplished by General Order No. 51, Adjutant General's Office, June 24, 1893.

By direction of the Secretary of War, upon the recommendation of the Surgeon-General of the Army, an Army Medical School will be established in the city of Washington for the purpose of instructing approved candidates for admission to the Medical Corps of the Army in their duties as medical officers.

The course of instruction will be for four months, and will be given annually at the Army Medical Museum, in Washington City, commencing on the first day of November.

Four professors will be selected from among the senior medical officers of the Army stationed in or near the city of Washington, and as many associate professors as may be required to give practical laboratory instruction in the methods of sanitary analyses, microscopical technique, clinical microscopy, bacteriology, urine analysis, etc.

1. McCulloch, Col. C. C.; *Scientific Monthly* 4: 410 (May) 1917.

The faculty of the Army Medical School will consist of—

1. A President of the Faculty, who shall be responsible for the discipline of the school, and who will deliver a course of lectures upon the duties of medical officers in war and peace (including property responsibility, examination of recruits, certificates of disability, reports, rights and privileges, customs of service, etc.).

2. A Professor of Military Surgery (including the care and transportation of wounded).

3. A Professor of Military Hygiene (including practical instruction in the examination of air, water, food, and clothing from a sanitary point of view).

4. A Professor of Clinical and Sanitary Microscopy (including bacteriology and urinology).

By command of MAJOR GENERAL SCOFIELD:

R. WILLIAMS, Adjutant General.

Official:

Assistant Adjutant General.

In announcing the members of the faculty, General Sternberg presented a brief statement outlining the purpose and plans of this new center of medico-military education, in which he declared that although there is no need to teach medicine or surgery to well educated graduates of our medical colleges, there are certain duties pertaining to the position of an Army medical officer, for which the college course of these young men has not prepared them, and certain of these duties are more important than the clinical treatment of individual cases of disease and injury, because the efficiency of a command, of an Army even, may depend on proper performance.

During the past twenty years the prevention of disease has made infinitely greater progress than its cure. Recognizing this fact health officers have been appointed, and health boards organized by civil communities for their own protection.

A special education is needful to prepare a medical man to undertake the responsibility of protecting the public health. The Army medical officer is the health officer of his command, but the young graduate seldom is equipped with the knowledge or experience necessary for efficient action in this position. The course at the Army Medical School will prepare him to cope with the question of practical sanitation that will be presented to him at every turn in his military career; questions of site, and soil, and buildings; of ventilation, heating and occupancy; of drainage, sewerage and disposal of garbage; of the wholesomeness of water supplies, and the various articles of food including the contractor's herd, the slaughterhouse, the subsistence,

storerooms, the kitchens and mess halls; the practical value of disinfectants, the bacteria which they destroy and the ptomaines which these elaborate—all bearing upon the preservation of the health of the military community under his sanitary care.

The school has already enjoyed many years of usefulness, and during the year 1917 graduated over 200 young medical officers. Those who have attended are sincere in their acknowledgment of the benefits derived from a thorough and practical course of instruction. I consider this school and the establishment of laboratories of bacteriology and hygiene one of the greatest achievements of General Sternberg's administration.

CONGRATULATORY MESSAGES

The selection of Dr. Sternberg as Surgeon-General of the Army evoked felicitous messages from a host of his friends, but none were so much appreciated as those which came from his colleagues and co-workers in the medical and scientific world. A few examples will serve to show their general import.

WASHINGTON, D. C., May 30, 1893.

Dear General:—

In sending my congratulations, I wish to say that when I nominated you for President of the Section on Military Surgery of the Pan-American Congress at St. Louis and fought it through . . . I had no idea that I was speaking for the future Surgeon-General, nor yet when I notified you that I named the new quarantine boat at San Francisco for you. I only recognized the accomplished medical officer and the skilled bacteriologist, and I am pleased that the high authorities having the appointing power have thus rewarded merit.

I am very truly yours,

JOHN B. HAMILTON.

Brig.-Gen. Sternberg,
Surgeon-General, U. S. Army.

WASHINGTON, D. C., May 30, 1893.

I cannot leave Washington without these few lines to say how pleased I am to be able to congratulate you on the well earned honor that has been conferred upon you.

It is peculiarly satisfactory to think that pure science has been recognized in this appointment.

Will you kindly convey my regards to Mrs. Sternberg and I am,

Sincerely yours,
H. P. WALCOTT.

Headquarters Department of Dakota,
ST. PAUL, MINN., May 30, 1893.

Surg.-Gen. George M. Sternberg, U. S. Army,
New York.

Dear Doctor:—

Although I have sent you a telegram of congratulations upon your richly deserved promotion, I cannot refrain from writing just a line to express my gratification over the President's handsome tribute to honest merit. When I think that it places at the head of the Corps the one man who preeminently stands forth as the representative of progressive scientific medicine and that it means that the fossil age has passed, I have an irresistible desire to toss my very hat in the air. I know what pleasure it will give to Professor Welch, Dr. Abbott and Dr. Councilman, all of whom have so many times spoken of your untiring energy and ability.

I shall always remember Dr. Abbott's remark, made to me on one occasion, when he said: "All that I am and know concerning bacteriology, I owe to a member of your Corps—Dr. Sternberg."

Having no favors to ask, my dear Doctor, I can all the more sincerely congratulate you.

Believe me, very truly yours,

WALTER REED.

5 West Fifty-eighth Street, NEW YORK CITY.

My dear Dr. Sternberg:—

I want to extend my warmest congratulations on your recent very well earned promotion. You are to be congratulated, however, not so much on the promotion, as that was deserved, but on the fact that your ability and scientific work have received the recognition they merit. I was delighted to hear of the appointment and the only regret associated with it is the fact that it takes you away from New York. I sincerely hope, however, that I may have the pleasure of entertaining you occasionally in New York when pleasure or business brings you here.

Very sincerely,

HERMANN M. BIGGS.

NEW YORK, May 31, 1893.

Dear Dr. Sternberg:—

I must congratulate you somewhat, the Medical Department of the Army more, and the great sanitary interests of the country most, on your accession to the Surgeon-Generalship. Your appointment is the best act yet performed by the President and deserves, as it will receive, the hearty commendations of medical men the world over. I am glad to see that you have a

decade of service—a period which will enable you to effect great reforms not only in your Department, but in the organization of a National Sanitary Service.

Very sincerely yours,

STEPHEN SMITH.

PHILADELPHIA, June 8, 1893.

My dear Doctor:—

Allow me to present you my warm congratulations. I only hope your new post will not interfere with the admirable scientific work for which we are all indebted to you.

Sincerely yours,

J. M. DA COSTA.

ATTENDING PHYSICIAN TO THE PRESIDENT

In 1893, President Cleveland not being in good health, his close personal friend and physician, Dr. Joseph D. Bryant, came at intervals from New York to see him and prescribe for him. Dr. Bryant asked General Sternberg if he would consent to see the President and prescribe for him should Mr. Cleveland require special medical care during Dr. Bryant's absence. General Sternberg agreed to respond to any call and to render every possible service. The President had great responsibility at that time and the constant anxiety caused by numerous important and vexatious legislative matters was a tremendous tax on his vitality. Dr. Sternberg became, therefore, a welcome adviser, and as the President's physician, he was greatly loved and trusted. He soon became very much attached to Mr. Cleveland, for they had many interests in common. Both were sons of ministers, and both had a feeling of loyalty and love for New York state. In due time they became very good friends.

General Sternberg's professional visits to the White House soon led to his being in request for members of the presidential family, when they needed medical advice. In the Executive Mansion, Mrs. Cleveland was a delightful hostess and was greatly loved and admired by all who knew her. She was a woman of wonderful beauty and grace, with the reputation of "never having made a mistake while presiding in the White House." She always said and did the correct thing, although she had come to play this very exacting role at an early age. The receptions and dinners at the Executive Mansion were brilliant and enjoyable, and at many of these we were invited to

the Blue Room to meet the Vice-President, the Supreme Court judges, the ambassadors, the cabinet officers, prominent Senators and Representatives, ranking Army and Navy officers, and distinguished visitors and guests. The home of the Secretary of War and Mrs. Lamont was also a popular rendezvous during his period of office. Mrs. Lamont's cordial manner caused all Army officers and their wives to feel that she really was interested in seeing them, and they went frequently to her receptions on Wednesday afternoons.

OFFICIAL ATTAINMENTS

General Sternberg soon reorganized the work of his office and inaugurated many new and important measures calculated to promote the efficiency of the Medical Corps. The routine work of the office was to him interesting and important. Friends constantly importuned him not to take the details too seriously, but to let others do more of the minutiae. While he was very fortunate in the selection of his associates, who gave their best efforts to the work, he could not for a moment forget his personal responsibility for every important transaction.

This devotion to the slightest detail of his position, together with special tours of inspection for the purpose of informing himself on conditions in the field, served to keep his time fully occupied. Before relating some of the achievements in the promotion of efficiency in the Medical Corps, a few words may be said of his disappointments. One of his ambitions, as shown by the establishment of the Army Medical School, was to have a thoroughly trained, full time corps of medical officers, well versed in sanitary science and preventive medicine. One can readily imagine his chagrin when, during the congressional session of 1893-1894, the House of Representatives deemed it in the interest of economy to reduce the numerical strength of the Medical Corps, actually contemplating a reduction of 85 in the number of Assistant Surgeons. General Sternberg did all in his power to prevent its enactment, but the bill as finally passed reduced the number of Assistant Surgeons from 125 to 110, and made no provision for the employment of Acting Assistant Surgeons under the former contract system. Hence, in 1894, private practitioners could be employed only by the visit, and they were not available for taking charge of a post hospital or

of the medical property, for the discipline and drill of the Hospital Corps, or for the sanitary supervision of a post, so necessary for the care of the sick and wounded. Nor could they be retained for medical service to the families of officers and enlisted men. In the bill from which I glean these facts, it is stated "that it may be necessary in several instances to employ outside attendance of physicians for the smaller posts, but that can always be done and efficient service secured at the cost of from one fifth to one fourth of the present average salaries of officers of the Medical Corps."

While it is true that practicing physicians from civil life had been employed in former years at the Arsenals and small military stations, it is a mistake to suppose that they could be employed at a regular garrison post, large or small, at the low estimate cited above. A post surgeon has varied and important duties to perform in addition to caring for the sick. His presence as a member of the garrison is more important than that of any other officer, for no other officer can perform the duties of the medical officer. When the matter was referred to him, the Major General commanding the Army replied that "at military posts it is, in my opinion, impracticable to supply the necessary service including that of the hospitals, in any other way than through the regular commissioned officers." Department commanders were of the opinion that "it was impracticable to substitute physicians living near a garrison for the regular Army medical officer." In spite of all the evidence in favor of an increase in the strength of the regular Medical Corps, it required many years to secure the necessary legislation.

But notwithstanding more or less discouragement and legislative embarrassment, General Sternberg gradually accomplished much that he had previously planned to do. He directed that medical officers be supplied with the most important recent medical books and that facilities of the Library of the Surgeon-General's Office be freely extended by mail or express to all medical officers engaged in literary research. He secured the assignment of medical officers to stations in large cities, thus affording them unusual advantages for clinical work and advanced medical studies, and he expected them to apply the knowledge thus gained in the treatment of the sick and wounded

and in the conservation of the health and efficiency of the troops. He made it a personal matter to see that every army hospital was properly equipped with a modern operating room and facilities for clinical microscopy, while the larger ones were supplied with roentgen ray apparatus, and bacteriologic outfits. He created a special hospital at Washington Barracks for the relief of permanent disabilities, and after a successful demonstration of the economic and humane advantages of this plan by Surgeon William C. Borden, he directed that surgical operation be attempted in cases of hernia and other curable disabilities, instead of discharging soldiers or retiring officers, thereby rendering them pensioners of the Government. In like manner, he recommended the establishment of a sanatorium at Fort Bayard in New Mexico for the treatment of pulmonary tuberculosis. This institution has accomplished great good, not merely by restoring many men to active duty again, but also by the humane care extended to the hopeless cases, and the protection afforded to the families of the afflicted and the community at large. Since its establishment in 1899 to March 31, 1920, it has cared for 12,984 patients. General Sternberg organized additional training schools for the Hospital Corps and made great improvements in the hospital accommodations at many of the military posts. He also carefully revised and markedly improved the plans of five new hospitals which were completed in 1895 at Fort Myer, Va., Fort McHenry, Md., Plattsburg Barracks, N. Y., Fort Meade, S. D., and Fort Harris, Mont. Previous to this date hospitals had been constructed during his administration at Washington Barracks, D. C., and at Fort Logan H. Roots, Ark.

In addition to his official duties, General Sternberg found time to complete an important treatise on *Immunity, Protective Inoculations in Infectious Diseases and Serum Therapy* (325 pp.) in 1895 and also prepared the second edition of his *Manual on Bacteriology* in 1896. General Sternberg was frequently urged to write articles for the medical journals and for the lay press to elucidate some scientific topic. Not having any children he was especially fond of writing articles for the *Youth's Companion* and he kept up these contributions until near the closing days of his life.

While Surgeon-General, Dr. Sternberg derived genuine social pleasure in the entertainment of guests and close friends as well as members of the Medical Corps. He was always considerate of foreign delegates to scientific meetings and of members of international congresses, for he had often received social recognition when representing the United States at international congresses in Paris, in Rome, and elsewhere. At other times he was in close touch with many of the men who were prominent in biologic work in our own country and in foreign lands. He was also in close affiliation with the members of the American Public Health Association, and with the leaders of the American Medical Association and of the Association of American Physicians.

In the fall of 1894, General Sternberg received a letter from General Miles directing his attention to Dr. Leonard Wood. True to his fixed policy to encourage recognized merit in members of the Medical Corps, he recommended the assignment of Dr. Wood for duty in Washington, where he remained until the outbreak of the Spanish War, having in the meantime also served as physician to the White House.

HEADQUARTERS DEPARTMENT OF THE MISSOURI
Office of the Department Commander

KANSAS CITY, MO., Oct. 7, 1894.

My dear General:—

It may be possible that in the many changes of station of troops it may involve some changes of the officers of the Medical Department.

Should this necessitate a change of station of Captain and Assistant Surgeon Leonard Wood, I would respectfully suggest and recommend that he be stationed at Washington, D. C. I feel that this consideration would be a just recognition of his valuable, laborious and dangerous services and it would greatly oblige

Your friend,
NELSON A. MILES,
Major General, U. S. Army.

Surg.-Gen. G. M. Sternberg,
Washington, D. C.

AT WOOD'S HOLE

In July, 1896, we spent some time at Wood's Hole in Massachusetts, which little vacation brought needed rest and recreation. While there, General Sternberg received an invitation to

spend a day with President Cleveland at "Gray Gables" and try the fishing in Buzzard's Bay. The President and the General put off in a little boat for the fishing holes, Mr. Cleveland in a picturesque outfit which made a lasting impression on the General, not the least unique feature of which was a soft hat, the band of which was filled with fishing hooks and flies of every kind.

One day when things seemed a trifle dull at the hotel, the proprietor invited the guests to a New England clam bake on the sea beach. I watched this entire procedure with much interest, for it seemed to me that it must have originated with the aborigines of our country. The men thoroughly cleaned some large flat stones, on which a huge fire was lighted. When the coals were a bright red, some sea weed was thrown over them, and the clams in the shell were placed on the steaming sea weed, then green corn, sweet potatoes, and lastly a loaf of Boston brown bread were heaped together. All was quickly covered with more sea weed to retain the steam. After an hour of steaming we were given plates containing a small cup filled with melted butter, in which we dipped the clams fresh from the shells. During our visit to Wood's Holl representatives of the Fish Commission were extremely courteous and kind. We were frequently invited to accompany parties going to gather fish and interesting specimens from the salt water. By invitation General Sternberg gave an illustrated lecture on immunity, the resisting power, natural or acquired, which living animals possess against invasion by pathogenic micro-organisms. He also lectured on biology at the Marine Biological Laboratory.

Our country was at that time in a great state of political excitement. It was election year, filled with interest for all parties. The enthusiastic nomination of William McKinley as candidate for President on the Republican ticket filled the hearts of the men of his party with confidence and hope. His previous years of training and responsibility as a member of Congress, and his experience as the governor of Ohio had signalized him as a man of superior ability, with the power to act promptly and intelligently in deciding great problems of state. He had a charming personality and had many warmly attached friends in all sections of the country and there was great rejoicing when the returns showed that he had been chosen to fill the highest office within the gift of the people.

The last winter of any administration in the White House is usually considered less brilliant socially, but we saw no evidence of this during Mr. Cleveland's term. The autumn and winter brought the usual activities, and the formal receptions at the White House were largely attended. Some time before the reception on New Year's Day, I had received a formal note from the President to be present in the Blue Room on that day.

PRESIDENT MCKINLEY

Early in February, 1897, President Cleveland sent a cordial and gracious letter to Mr. McKinley, his successor, with an invitation to dine at the White House on the eve of his inauguration, to which the President-Elect replied in the most appreciative manner, and those who know assert there was sincerity in the exchange of greetings between the two men, each of whom entertained genuine good feelings of respect and admiration for the other, notwithstanding their diverse political opinions. When Mr. McKinley was inaugurated as President of the United States, March 4, 1897, we were sent special tickets of admission to the Senate wing to witness the impressive ceremonies. Our new President was soon confronted with perplexing and delicate problems. His first act was to issue a call for an extra session of Congress to revise the Wilson tariff; all his close friends knew that Mr. McKinley regarded this as the principal cause of business depression in the preceding four years.

Although there was a medical officer on duty at the White House, the state of Mrs. McKinley's health was such that General Sternberg was asked to see her frequently and advise in regard to her care and medical treatment. The call for these visits came almost daily as Mrs. McKinley was constantly overtaxed by the strain of social duties. In years of intimate association we learned to love and esteem President McKinley and his wife very highly. It is the opinion of all who knew the President, that the happiness of his invalid wife was at all times his first thought. We were frequently with them for informal family and holiday dinners. They received in the red parlor, as it was then known, and we generally found them during the winter evenings before the open hearth fire, made from drift wood sent by a devoted friend from the coast of

Massachusetts. There was always a most cheerful greeting awaiting one. I shall not soon forget one Christmas dinner: The turkey was a large one, and it was sent to the table on a platter for the President to carve. He did this in a very skilful manner, making merry meanwhile, in full enjoyment of the holiday spirit. Later in the evening other intimate friends came, and we were all invited to the blue room, where we disported with music, singing and a cotillion.

One of my great treasures is a personal note from President McKinley to be present in the blue parlor during the reception on New Year's Day. With what pride and interest I watched him greet his fellowmen on that day! Courteous in manner at all times, he had the correct bearing and dignity which one likes to observe in the President of our great Republic. The sun shone brightly that day and many people came to pay their respects during the reception. A number greater than usual having been received, the officer in charge of the ceremony informed the President that the time for closing had arrived. The President asked: "How many are outside waiting?" The officer replied that the line was long and there must yet be hundreds. "Let them come," said Mr. McKinley, "I do not wish to feel that any one has been shut out and disappointed."

CHAPTER TWELVE

INTERNATIONAL MEDICAL CONGRESS AT MOSCOW

In the spring of 1897, General Sternberg received unofficial information that, at the request of the Secretary of State, he would most likely be designated as one of the official delegates from the United States to the International Medical Congress to be held in Moscow, from August 19 to 26. Official notice of their selection as delegates came to General Sternberg and Deputy Surg.-Gen. David L. Huntington, March 12, and a few months later the following additional instructions were forwarded by the Adjutant-General:

Sir: —

I have the honor to inform you that in complying with so much of paragraph 3, Special Orders No. 58, March 12th, 1897, from this office, as requires you to attend the Twelfth International Medical Congress, to be held in Moscow, Russia, in August next, the Secretary of War directs as necessary to the public service, that you proceed via Hamburg, Copenhagen, Stockholm and St. Petersburg, and that upon the adjournment of the Congress you return via Warsaw, Vienna, Munich, Strassburg, Paris and Cherbourg.

Very respectfully,
GEO. D. RUGGLES, Adjutant General.

General Sternberg, always anxious that I should enjoy the benefit of travel, invited me to accompany him. In order to comply with the instructions from the War Department we left New York, July 22, on the S.S. *Fuerst Bismarck* for Hamburg. Although the morning of our departure was dreary, we enjoyed fine weather all the way over, and arrived in excellent spirits at Plymouth at 4 a. m., July 29, making Cherbourg at 11:30 the same morning. We arrived at Cuxhaven at noon on the next day and departed by train for Hamburg, where we arrived at 6:30 p. m. In Hamburg we stopped at the Hotel Kronprinz where we were made most comfortable, resuming our travels August 1. Our journey was by rail to Kiel, thence by boat to Kossar, where we entrained for Copenhagen. Leaving Copenhagen at 10 a. m., August 4, we proceeded by boat to Malmo, and from there by train to Stockholm. This stretch was very

interesting, for we passed through a fertile, beautiful country, the fields of which were full of golden shocks of newly harvested grain. At 9:30 we stopped for supper at a large restaurant, where we were first introduced to a system of table service now familiar to patrons of a "cafeteria."

We arrived at Stockholm the following morning, and drove to the Grand Hotel. A large fair was going on in the city at that time, which gave us an excellent opportunity to observe the customs of the Swedish people. The costumes of some of the peasants we found very interesting, many being quite becoming and picturesque. The thing I enjoyed most was taking our after dinner coffee in the public garden, to the strains of music furnished by the military band. I was amazed at the long twilight, for at 10 o'clock it was still quite bright. We left Stockholm by the Russian S.S. *Nord Kustou* for St. Petersburg. Unfortunately we had failed to make timely reservations of staterooms and the steamer was greatly crowded. Thanks to our special passes and letters from the Secretary of State, the captain very courteously assigned his room to me and Mrs. W. K. Van Reyphen (wife of the Surgeon-General of the Navy, the delegate appointed to represent the Medical Department of the Navy). General Sternberg and Admiral Van Reyphen were given resting places for the night on a divan in the dining room. We enjoyed a fine run among the beautiful islands of the Baltic to Abo, the former capital of Finland, dating its birth to 1157. At the time of our visit it had a population of about 33,000. We drove in a "droshky" around the city, and visited the famous church of St. Mary on the Aura, north of Abo. Our steamer continued on a fine passage among the many islands to Hangö, a favorite water resort for English tourists.

We arrived at Helsingfors August 12, and to our great satisfaction we were able to get a stateroom on the steamer at that port, as many of the passengers left at Helsingfors. The city was beautifully clean and mostly new, for after the burning of the city in the subjugation to Russia, the government sent Germans to plan a new capital, and the buildings that were then constructed reflect credit on the engineers and architects. The city boasted a splendid university with an enrolment of about 2,500 students in the various departments, about one fifth of whom are women.

Our steamer pitched terribly in the Gulf of Finland and we were exceedingly glad to arrive at Cronstadt on the morning of August 13, enjoying a fine view of the port and the war vessels lying there. We were now growing anxious to reach St. Petersburg, which we did at 8 o'clock the following morning. As our baggage was to be inspected by a Russian officer on board the steamer, Mrs. Van Reypen and I kept watch over the hand luggage, while General Sternberg and Admiral Van Reypen went below to supervise examination of the trunks. Very soon a servant came hastily into the cabin, seized our small bags and rushed to the gang plank; I followed him to the wharf. He hastily dropped the bags, and ran back to the steamer. I looked around, but I saw only an excited surging crowd, not one friendly face, and no passport in my possession. I could not return to the vessel, and Mrs. Van Reypen was prohibited from leaving the ship, and the situation caused me some excitement. An officer came up, apparently in a friendly spirit to aid me. Alas! We spoke no common language. I spoke French, he replied in German; I spoke no German, and he did not understand English. After considerable delay, as is usual in customs proceedings, I was joined by the other members of our party. With one exception all laughed at my experience; I could see no humor in the occurrence. We took a "droshky" and drove to the Hotel de France, where we found very comfortable quarters during our entire stay. Our passports were taken by the hotel clerk, and by this token the hotel seemed to have assumed entire responsibility for our good conduct, for we did not again see the passports until we were leaving the city.

St. Petersburg was built almost at the command of one man, and strikes a stranger as a brilliant display of domes, pinnacles and churches. We walked and shopped on gay "Nevsky Prospekt," where the shop windows are ablaze with diamonds and precious stones, where the display of beautiful furs is in keeping with other gorgeous and rich things. St. Isaacs, located in the Alexander Garden near the great Admiralty Building, takes precedence among the churches; its main cupola and the surrounding lantern and cross are overlaid by 200 pounds of gold leaf. The pillars on the porticos are sixty feet high, each a single shaft of exquisite Finland granite, while over all rises an immense bronze dome, in keeping with the general architecture.

The interior is set off with columns of lapis-lazuli and malachite, and rare paintings and brilliantly jeweled ikons adorn the walls. The worshipers kneel on the cold marble floor, and during the service they touch the marble paving stones with their brows in reverence. We also visited the "Hermitage," the house of Peter the Great, the Winter Palace, and the Church of Peter and Paul in the fort, where are buried all the czars of Russia (except Peter II, who removed the court to Moscow, and died there of smallpox). Each sarcophagus in this church bears the name of a sleeping czar or his consort, and is distinguished by the double eagle and the "eternal light."

We left St. Petersburg with regret, and turned our faces toward Moscow, reaching there August 18. Officials of the Congress arranged for our comfort at the Knagi Dvor (Princes Hotel), a new club house which had been placed at their disposal. We found this to be a beautiful, new, up-to-date building, and we were assigned to a charming suite, consisting of two bed rooms, a large dining room, reception room, with a balcony and an inviting entrance hall.

On the morning of the 19th, General Sternberg and Admiral Van Reyepen attended the opening session of the Twelfth International Congress of Medicine, which was held in an immense and beautiful theater with five tiers of boxes. They were both very much interested in the program of the congress, which they attended at every session. General Sternberg enjoyed immensely not only the scientific program, but also the personal contact with men whom he knew by correspondence and with the military medical officers representing other countries. One evening, soon after he had registered as a member of the congress, when we were alone, he told me that all the Surgeon-Generals representing other nations held the rank of Major-General, that he was the only Brigadier-General as the chief of the medical corps of an army, and the others knowing of his achievements had expressed surprise that his Government had not rewarded him accordingly. Before parting company the military surgeons present in the congress had a group photograph taken, of which General Sternberg brought me a beautiful copy. I was pleased with it for it was a fine group of men, but I said: "Why, my dear, you are in the front seat in the front row." This seemed to me extraordinary, for he

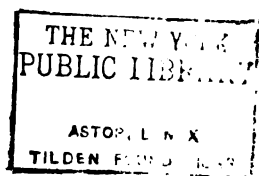
was always a very modest, unassuming man. He looked at me with a happy twinkle in his brown eyes, and replied, "I am in that position because the military surgeons representing other countries placed me there. When I remonstrated they said: 'that is where you belong, in the very front of medical science of the present day.'"

The adjournment of the congress and the time for our departure soon arrived, and we packed our baggage to turn our faces homeward. Washington was beckoning us across the water, and General Sternberg was very anxious to resume his duties and be again at home. We left Moscow on the evening of August 25, on our way to Warsaw, arriving there on the 28th, and proceeding to Vienna. While the trip to Vienna was interesting, General Sternberg was disappointed on reaching there in not finding his professional friends whom he wished particularly to see in or near Vienna. They were still far away at their country places. But for me the city was charming, beautiful and gay and most fascinating even in summer. Admiral and Mrs. Van Reypen had gone to Paris by way of Berlin and had arranged for us to stop with them at the Hotel Chatham. Here we met again September 5, and while we ladies went shopping, our husbands visited professional friends, military hospitals, the military medical school, and the museum of hygiene at Val de Grâce.

On the morning of September 17, we left Paris at 8:45 for Cherbourg. There we went at once on board the tender and steamed out behind the breakers to wait for the S.S. *Columbia*, which was to carry us back to our home.



Honorary Presidents and Secretaries of the Section on Military Medicine,
Twelfth International Congress of Medicine,
Moscow, Aug. 19-26, 1897.



CHAPTER THIRTEEN

PRESIDENT OF THE AMERICAN MEDICAL ASSOCIATION

Despite the fact that the administrative duties in the Surgeon-General's Office occupied him fully, General Sternberg maintained an active interest in the work of medical and scientific societies. He frequently attended the meetings of the Medical Society, the Biological Society and the Philosophical Society of the District of Columbia, before each of which he occasionally read addresses on some aspect of scientific medicine. He took a prominent part in the work of the American Public Health Association, and he was a familiar figure at the meetings of the American Medical Association and the Association of Military Surgeons of the United States. At one time or another he had been elected president of each of these societies, and he was, in addition, member and ex-president of the Association for the Prevention of Tuberculosis of the District of Columbia and of the Cosmos Club, chairman of the President's Homes Commission, president of the section on military medicine of the Pan-American Medical Congress, honorary member of the American Association of Physicians, the Association of American Medical Colleges, the American Academy of Medicine, the Epidemiological Society of London, the Academy of Medicine of Rio de Janeiro and the French Society of Hygiene, and fellow of the New York Academy of Medicine and, by courtesy, of Johns Hopkins University. The honorary degree of LL.D was conferred on him, in 1894, by the University of Michigan and, in 1897, by Brown University.

General Sternberg was not insensible to the honors which his medical confrères and scientific co-workers had bestowed on him, but none brought him more lasting satisfaction than his election as president of the American Medical Association at its semi-centennial meeting in Philadelphia, June 4, 1897. His personal friends regarded the election as a recognition of his scientific attainments by the representative body of American physicians. During his incumbency, General Sternberg kept in close touch with the executive offices of the Association

and found great satisfaction in the progressive spirit which was manifest in its campaign for the elimination of inferior schools and the adoption of a higher standard of medical education, for the suppression of the nostrum evil and for the instruction of the public in matters pertaining to hygiene. Unfortunately, our country was at war with Spain in the spring of 1898, and to his keen regret, General Sternberg was prevented by the duties of his office from attending the meeting of the Association at Denver. He had, however, prepared an address which was read by his friend and colleague, Colonel Alfred A. Woodhull. In this paper, General Sternberg was at his best; in it are attested his sincere devotion to the cause of scientific medicine and advanced medical education, as will appear from a few extracts.

EXTRACTS FROM THE PRESIDENTIAL ADDRESS

Scientific medicine, being founded upon demonstrable truths, must in the end maintain itself and secure the confidence of the people. But when the results of scientific research are rejected through ignorance of the experimental data upon which they are founded, and the layman hears contradictory professional opinions about matters which the well informed knows to be definitely settled, he may be excused for not differentiating so sharply as we are disposed to do between regulars and irregulars. To maintain our standing in the estimation of the educated classes we must not rely upon our diplomas or upon our membership in medical societies, but must show ourselves superior in knowledge and in professional resources to the ignorant pretender or to the graduate of a medical school which is bound in its teachings by an untenable creed, adopted before the light of science had taught physicians to reject theories and the dicta of authorities in favor of truths demonstrated by modern methods of research. There are those who still speak of us as "old school physicians," ignorant apparently of the fact that scientific medicine is to a great extent of very recent origin, and that all of the great discoveries in relation to the etiology, prevention and specific treatment of infectious diseases, and nearly all the improved methods and instrumental appliances for clinical diagnosis and surgical treatment have had their origin within the ranks of the regular profession. While, therefore, we still have with us some "old school doctors," who have fallen behind the procession, the profession as a whole has been moving forward with incredible activity upon the substantial basis of scientific research, and if we are to be characterized by any distinctive name, the only one applicable would be "*the new school of scientific medicine.*" Not

that our science is complete, for we have still many things to learn and many problems which have thus far resisted all efforts at their solution; but we have learned how to attack these problems and no one any longer expects that they can be solved by the exercise of the reasoning powers and the facile use of the pen.

EDUCATION OF THE PUBLIC

Through many years General Sternberg was wont to give public lectures on topics relating to sanitation and hygiene. He considered it the function of the physician to popularize knowledge regarding infectious diseases and preventive medicine, and to this end he took infinite pains to make his own lectures on such subjects entertaining and informative.

The old saying has it that "the pen is mightier than the sword." This is no doubt true in politics, but in science the pen is a feeble instrument compared with the test tube, the microscope, the chemical balance, etc. Nevertheless, I am about to advise well-informed physicians to make greater use of the pen, not for the elucidation of these problems which remain to be solved, but for the purpose of calling the attention of the nonmedical portion of the community to the recent achievements of scientific medicine. It is a remarkable and lamentable fact that persons belonging to the so-called educated classes are grossly ignorant as regards the present status of medical science. They not only speak of us as "old school doctors," but they entrust their lives and those of their children to pseudo-scientists who, taking advantage of popular interest in the great discoveries of the day, make extravagant claims as to the curative power of electricity, the X-ray, oxygen, ozone or some wonderful miracle destroyer. Or, ignoring the exact knowledge which has been gained by experience and painstaking researches with reference to the etiology of various diseases and the curative action of approved therapeutic agents, they accept the vagaries of the osteopath and the christian scientist as representing the latest development of scientific progress in medicine. The false assertions and claims of ignorant enthusiasts and conscienceless vampires, as a rule, pass unchallenged. Not only are they able to impose upon a gullible public through their published advertisements, but articles written by them or for them appear in the columns of reputable newspapers. The ever-present and irresponsible newspaper reporter espouses their cause through ignorance or for gain and their wonderful cures are related and copied from one paper to another without any competent critic raising his voice to show the fallacy of the claims. Again, positive denials of the

well-established achievements of scientific medicine are often made, unfortunately too often, by men who are authorized to attach the letters M.D. to their signatures.

THE NOSTRUM EVIL

It was also necessary and desirable to instruct the laity in regard to the nostrum evil for there were always unscrupulous quacks preying on the gullible members of the community.

For the illiterate and even for many of the so-called educated class the whole of medicine consists in the cure of disease by medicines, or by some agency, natural or supernatural, and a failure to cure is evidence that medicine is not a science. We readily admit that the cure of disease is one of the principal objects which medical science has in view, and that from a scientific standpoint therapeutics is very much behind some of the other branches of medicine. This is shown by the diversity of remedies prescribed for certain diseases, and the failure of any one of these remedies to effect a cure in many cases. But on the other hand, therapeutics has made great advances during recent years and by the application of scientific methods of research, the exact value of alleged remedies and of various methods of treatment is now determined with far greater precision than formerly.

The fact that a considerable proportion of those who are sick from various acute or chronic ailments recover after a time, independently of the use of medicinal agents or methods of treatment taken in connection with this tendency to ascribe recovery to the treatment employed, makes it an easy matter to obtain certificates of cure for any nostrum which an unprincipled money-seeker may see fit to offer a credulous public.

ENEMIES OF SCIENTIFIC MEDICINE

Sincere but misguided enthusiasts were banded together to obstruct scientific medicine: the campaigns against vaccination and animal experimentation were often unwittingly aided by haphazard statements of certain thoughtless physicians. Even physicians of reputation were sometimes wont to refute new discoveries in advance of careful study and thorough trial, and such denial served only to confound the general public and to fortify the position of the enemies of medicine.

As a result the anti-vaccination and anti-vivisection societies are able to fortify their position by quoting the opinions of medical men of more or less repute. But opinions are of no value when opposed to evidence, and it seems to me that those familiar with the evidence would do well to give to the public concise and comprehensible statements, suitable for publica-

tion in newspapers and popular magazines, setting forth the facts and the evidence upon which these facts are accepted by well-informed physicians. But in doing so, great care should be taken not to make any assertions that are not based upon reliable data.

Whenever any new discovery in medicine is announced some conservative physicians, and often men of reputation in the profession, are sure to commit themselves to a positive denial of the alleged fact. This occurred when the discovery of the tubercle bacillus was announced by Koch, it has occurred with reference to the treatment of diphtheria by antitoxin, and to the preventive treatment of hydrophobia by Pasteur's method. Yet these discoveries are based upon experimental evidence of the most unimpeachable character. To deny their reliability at the present day is simply to show ignorance of the nature of this evidence or a failure to appreciate its scientific value. Often the positive and premature statements of a physician relating to new discoveries in medicine are corrected, or at least regretted, at a later date; but sometimes the pride of opinion prevents a retraction in the face of the most conclusive evidence. The result is that such opinions, although they may have been given years ago, are always available to controvert the statements of those who maintain the value of vaccination, of experiments on the lower animals, of the diphtheria antitoxin, etc., and the non-medical public very often accept the opinions which coincide with their preconceived views, or arrive at the conclusion that there is nothing settled in our so-called medical science.

HIGHER STANDARDS OF MEDICAL EDUCATION

This evil could best be remedied by elevating the standard of medical education, by training the modern physician in the laboratory sciences in order to inculcate respect for experimental evidence as opposed to the dictum of self-constituted authority. On this point General Sternberg said:

It should be our aim to remedy this evil by elevating the standard of medical education, as we are doing in many parts of the country, by impressing upon the rising generation of physicians the importance of laboratory work not only as a means of instruction, but for the purpose of cultivating a scientific spirit of inquiry and just appreciation of the value of experimental evidence; and, finally, by instructing the public with reference to the present status of scientific medicine, the difference between fact and fancy, between the vagaries of the imagination and the demonstrable results of scientific investigation.

With the progress of scientific medicine, we have improved methods of teaching, and it is now generally recognized that reading medical books and listening to lectures is not a sufficient preparation for the practice of medicine, any more than the reading of books on navigation would be for the responsible position of captain of an ocean steamer. It is for this reason that we insist upon the study of anatomy in the dissecting room, the teaching of methods of diagnosis and treatment at the bedside, and of chemistry, physiology and pathology in the laboratory. It is only within the last few years that our leading medical colleges have provided suitable facilities for practical laboratory work and even at the present day, as I understand, the laboratory courses are not compulsory in some institutions which provide for a four years' course of study as a requisite for receiving the degree of doctor of medicine. From my point of view these laboratory courses are a most essential part of the medical curriculum, not only because the student becomes familiar with the use of instruments and methods which will be of inestimable value to him in the practice of his profession, but especially because of the effect of the kind of training he there receives in enabling him to judge of the imperfections of our unaided senses and the small value of opinions in comparison with that of facts capable of demonstration; as also the relative importance of many things which to the superficial observer might appear to be insignificant and unworthy of attention. He learns not to accept the assertion of the professor if this is in conflict with the experimental evidence which he is able to verify for himself. On the other hand, he learns not to have an overweening confidence in his own judgment and powers of observation. He may fail to demonstrate the flagella on the typhoid bacillus, or the presence of the plasmodium in the blood of a malarial fever case, or of a trace of arsenic in the tissues of one who died with symptoms of arsenical poisoning, but having learned by repeated investigation that the failure was due to his want of expert skill in the use of the microscope or in the application of delicate methods of investigation, he learns that it is unscientific and injudicious to give a premature opinion in regard to any subject under investigation, and especially so when this opinion is based upon negative evidence.

I have spoken of the danger of arriving at hasty conclusions upon negative evidence, and wish now to call attention to the fact that physicians too often fail to recognize the value of negative evidence as opposed to the deductions made from facts coming under their immediate observation. Thus, a case of paralysis following diphtheria may be ascribed to the administration of diphtheria antitoxin, but in view of the fact that paralysis often follows diphtheria when no antitoxin has been

given, and of the negative evidence relating to the administration of the antitoxin in thousands of cases and in immunizing doses in other thousands of individuals, the deduction in a particular case that paralysis and the administration of antitoxin stand in the relation of cause and effect may well be doubted. Again, when a case of yellow fever occurs in one of our seaport cities, failure to trace the channel of infection has not infrequently led to the inference that the disease was of local origin. The fallacy here depends upon the assumption that the investigation has excluded all possible avenues for the importation of the infectious material from a foreign source, and a want of appreciation of the negative evidence which shows that yellow fever epidemics never have their origin at interior towns, and that they do not originate at towns on the sea-coast which have no foreign commerce. As well might we conclude, as perhaps some have done, that a case of smallpox is of *de novo* origin because the physician who sought to find the source of contagion was unable to do so. The negative evidence, relating to the non-occurrence of smallpox among persons not exposed directly or indirectly to contagion, is so conclusive that the profession accepts it as a fact that this disease does not originate independently of a previous case.

FOUNDATIONS OF SCIENTIFIC MEDICINE

Evidently scientific medicine must be founded upon an exact knowledge of the structure (anatomy) and functions (physiology) of the human body in a healthy condition and of the changes in structure and function (pathology) which result from various disease processes; of the causes (etiology), natural history (clinical medicine) and regional distribution (medical geography) of the diseases which afflict mankind and the lower animals (comparative pathology); of the toxic action of various substances from the animal and vegetable kingdom (toxicology), and of the use of these and of other non-toxic substances, physical agents, etc., in the treatment of disease (therapeutics) and of the prevention of disease by disinfection, quarantine, protective inoculations, etc. (prophylaxis).

While scientific medicine could not exist independently of these fundamental branches, they simply constitute the basis upon which the superstructure has been reared, to a large extent during the last half of the present century. The histologic changes which occur as a result of various disease processes, were unknown and unknowable in advance of the invention of the compound microscope, and the same is true as regards the etiology of infectious diseases.

PREVENTIVE MEDICINE

Scientific medicine has as its ultimate goal the eradication of all preventable disease by the united efforts of trained labora-

tory workers and practical sanitarians. In General Sternberg's opinion, the advancement of preventive medicine is a measure of the progress of medical science.

Where thousands have been saved by the timely administration of suitable medicines, or by the skilfully performed operation of the surgeons, tens of thousands have been saved by preventive medicine. And preventive medicine is today established upon a strictly scientific foundation. If our practice was *pari passu* with our knowledge, infectious diseases should be almost unknown in civilized countries, and those degenerative changes of vital organs which result from excesses of various kinds would cease to play the leading part in our mortuary statistics. But while our knowledge is still incomplete in some directions, and while individuals and communities constantly fail to act in accordance with the well-established laws of health and the scientific data which furnish the basis of preventive medicine, the saving of life directly traceable to this knowledge is enormous.

Smallpox no longer claims its victims in any considerable numbers except in communities where vaccination is neglected; cholera has been excluded from our country during the last two widespread epidemics in Europe and its ravages have been greatly restricted in all civilized countries into which it has been introduced; the deadly plague of the seventeenth and eighteenth centuries is no longer known in Europe, and the prevalence of typhus (so-called "spotted" or "ship fever") has been greatly limited. Typhoid fever, tuberculosis and diphtheria are still with us and claim numerous victims, but we know the specific cause of each of these diseases; we know where to find the bacteria which cause them and the channels by which they gain access to the human body, and we know how to destroy them by the use of disinfecting agents.

The mortality from tuberculosis is constantly diminishing in our large cities, and the complete destruction of the infectious sputa of those suffering from pulmonary tuberculosis would no doubt go a long way toward the extermination of this fatal disease.

For a long time vaccination as a means of preventing smallpox stood as a solitary example of prophylaxis by inoculation with an attenuated virus. But Pasteur and others following in his footsteps have shown us that protective inoculations may be successfully practiced in several of the infectious diseases of the lower animals. Haffkine's cholera inoculations appear to have been attended with considerable success, and recent experiments in inoculating susceptible persons with cultures of the typhoid bacillus give some encouragement to the

belief that they may be rendered immune against typhoid fever by this method. That children may be rendered immune against diphtheria by comparatively small doses of the anti-toxin is well established. The value of Pasteur's method of inoculation for the prevention of hydrophobia in persons bitten by rabid animals is now generally recognized by well-informed physicians.

CHAPTER FOURTEEN

SPANISH-AMERICAN WAR

During the Spanish-American War, General Sternberg met all the increased demands upon his corps with efficiency in the face of legislative embarrassment and administrative obstacles, establishing a corps of female nurses for service in permanent hospitals, increasing the medical staff by officers selected from the Association of Military Surgeons, and afterwards supervising the organization of medical service in our tropical possessions.¹

At the International Medical Congress at Moscow in 1897, discussion of the experiences of the medical departments of the foreign armies and navies had given General Sternberg renewed inspiration and incentive. He hoped that he might be able to induce the country to adopt the best of tried measures. His efforts were doomed to repeated disappointment. Congress was at the time greatly absorbed in the subject of fiscal economy and instead of increasing the Medical Corps, there seemed to be a determined effort to reduce its numbers. Recommendations for appropriations were ignored and there was little interest in military preparedness. Even in 1897 it was clearly seen by Army men that war with Spain was inevitable, and it was apparent that we should prepare for the contingency. But recommendations to Congress were sterile of result until war was actually on us.

March 9, 1898, Congress appropriated "for national defense" the sum of \$50,000,000 — no part of which sum was to be available for offensive purposes, even for offensive preparations. The fund, although placed at the President's disposal, was confined to expenditures for purposes literally within the foregoing limitation. Under this interpretation of the Act, it was permissible to hasten the work on the coast fortifications, plans for which had been formulated and sanctioned by Congress, but no new projects could be initiated. In comparison with the other bureaus of the War Department, however, the Ordnance, Engineer and Signal Corps were given favorable consideration.

1. McCulloch, Col. C. C.; *Scientific Monthly* 4: 414 (May) 1917.

General Sternberg's official report on the activities of the Medical Department during the war portrays the difficulties under which he labored.

The Quartermaster, Commissary and Medical departments up to April 23, 1898, had been denied the privilege of endeavor. Under the President's interpretation of "national defense," these had not been permitted to take a step out of the ordinary routine. They could not procure or order any equipment, clothing, tentage, harness, commissary stores, or medical and hospital supplies, camp furniture and other materials in excess of the ordinary supply as of March 9, 1898.

War was declared on April 21, 1898, when Minister Woodford was handed his passport at Madrid. The formal declaration of war by Congress April 25, contains the statement "that war has existed since the 21st day of April."

April 23, the President issued a call for 125,000 volunteers and within twenty-four hours the nation was aflame. Tenders for service came by the hundreds of thousands. It is safe to say that a million men offered themselves, where 125,000 had been called.

On the first of April, 1898, our standing Army consisted of 2,143 officers and 26,040 men, a small nucleus about which had to be organized the great army for 1898. With this small organization we were to muster and equip, organize and mobilize, not only the first increment of volunteers but all subsequent levies aggregating with the regular army approximately 275,000 men. The number of medical officers of the regular Army (192) was totally inadequate even in time of peace, while this number included the fifteen additional Assistant Surgeons authorized by the Act approved May 12, 1898. Later in May there were thirteen vacancies. Of the remaining officers, six were engaged in administrative duties in the office of the Surgeon General, and in superintendence of the Army Medical Museum and Library and Army Medical School; eleven were on duty at medical supply depots, and as chief surgeons of military departments; one at the United States Soldiers' Home; fifty-six at general hospitals and at garrisoned posts; one as colonel of a volunteer regiment [Dr. (now General) Leonard Wood]; while four were disabled. One hundred officers were thus left for field service, five of whom were placed on duty as chief surgeons of Army Corps; thirty-six as brigade surgeons of volunteers and fifty-nine as regimental surgeons and assistants with the regular troops. The insufficiency of the last mentioned number was made up by assignment of medical men under contract. It should be added that the Hospital Corps consisted of 723 enlisted men. All volunteer regiments had

three medical officers appointed by the governors of states; volunteer surgeons to fill the staff positions authorized by the Act of approval April 22, 1898, were appointed by the President. There were in all eight corps surgeons with the rank of Lieutenant-Colonel, and one hundred and ten division and brigade surgeons with the rank of Major, five of the former and thirty-six of the latter positions were filled by the appointment of officers of the Army Medical Department. The President also appointed three medical officers for each of the regiments of the United States Volunteers, infantry, cavalry and engineers. As a very small proportion of these medical officers had military experience, the efficiency of the department was impaired at the outset, but very many of the staff surgeons from civil life showed great aptitude for the service and speedily became of value as administrative officers.

In less than thirty days practically all of 125,000 volunteers of the first call had been mustered in, and together with the available regular troops were mobilized at Tampa, Mobile, Washington and Chickamauga Park. May 25, less than five weeks after the first call, an expedition sailed from San Francisco for the Philippines. In less than seven weeks an army of 17,000 set out for Santiago. Owing to the limited number of officers and the great amount of work to be accomplished "the War Department requested authority from Congress to issue commissions for active service to retired officers. This authority Congress denied. From the regular army, therefore, was taken the minimum of officers consistent with the efficiency of every branch, an efficiency that is the rock upon which this country must always build its hopes for effective operations during the first few months of any war in which it may be engaged so long as the militia is organized as it now is.

General Sternberg realized very fully the difficulties, dangers and far-reaching consequences incident to the enrolment of medical officers, who had neither training in military hygiene, camp sanitation, or in medicomilitary administration in general. With less than 200 regular medical officers and no time to place newly appointed medical officers in schools of instruction, General Sternberg could only place the best men of his corps in positions of responsibility, where they would be able to instruct and direct the new appointees. Two important circulars for the information and guidance of the Medical Corps were issued; one almost immediately after the declaration of the state of war.

CIRCULAR NO. 1

Surgeon General's Office,
Washington, April 25, 1898.

In time of war a great responsibility rests upon medical officers of the Army, for the result of a campaign may depend upon the sanitary measures adopted or neglected by commanding generals of armies in the field. The medical officer is responsible for proper recommendations relating to the protection of the health of troops in camp or in garrison, and it is believed that as a rule, medical officers of the United States Army are well informed as to the necessary measures of prophylaxis and the serious results which infallibly follow a neglect of these measures especially when unacclimated troops are called upon for service in a tropical or semitropical country during the sickly season. In Cuba our armies will have to contend not only with malarial fevers and the usual camp diseases—typhoid fever, diarrhea and dysentery—but they will be more or less exposed in localities where yellow fever is endemic and under conditions extremely favorable for the development of an epidemic among unacclimated troops. In view of this danger, the attention of medical officers and of all others responsible for the health of our troops in the field, is invited to the following recommendations:

When practicable camps should be established on high and well-drained ground not having been previously occupied.

Sinks should be dug before a camp is occupied, or as soon after as practicable.

The surface of fecal matter should be covered with fresh earth or quicklime or ashes three times a day.

New sinks should be dug and old ones filled when the contents of the old ones are two feet from the surface of the ground.

Every man should be punished who fails to make use of the sinks.

All kitchen refuse should be promptly buried and perfect sanitary police maintained.

Troops should drink only boiled or filtered water, coffee or tea (hot, not cold) except when spring water can be obtained which is pronounced to be wholesome by a medical officer.

Every case of fever should receive prompt attention. If albumen is found in the urine of a patient with fever it should be considered suspicious (of yellow fever) and he should be placed in an isolated tent. The discharge of patients with fever should always be disinfected at once with a solution of carbolic acid (5 per cent.) or of chlorid of lime (6 ounces to the gallon of water) or with milk of lime, made from fresh quicklime.

Whenever a case of yellow fever occurs in camp, the troops should be promptly moved to a fresh camping ground located a mile or more from the infected camp.

No doubt typhoid fever, camp diarrhea, and probably yellow fever are frequently communicated to soldiers in camp through the agency of flies, which swarm about fecal matter and filth of all kinds deposited upon the ground or in shallow pits, and directly convey infectious material, attached to their feet or contained in their excreta, to the food which is exposed while being prepared at the company kitchens or while being served in the mess tent. It is for this reason that a strict sanitary police is so important. Also because the water supply may be contaminated in the same way, or by the surface drainage.

If it can be avoided, marches should not be made in the hottest part of the day—from 10 a. m. to 5 p. m.

When called upon for duty at night or early in the morning a cup of hot coffee should be taken. It is unsafe to eat heartily or drink freely when greatly fatigued or overheated.

Ripe fruit may be eaten in moderation, but green or overripe fruit will give rise to bowel complaints. Food should be thoroughly cooked and free from fermentation or putrefactive changes.

In decidedly malarious localities from 3 to 5 grains of quinine may be taken in the early morning as a prophylactic, but the taking of quinine as a routine practice should only be recommended under exceptional circumstances.

Light woolen underclothing should be worn and when a soldier's clothing or bedding becomes damp from exposure to rain or heavy dews the first opportunity should be taken to dry it in the sun or by fires.

A noted sanitarian in addressing the Medical Society of the District of Columbia in October, 1898, said: "Had the lessons of the Civil War and the note of warning sounded by Surgeon-General Sternberg in his famous circular of April 25, 1898, four days after the declaration of the Spanish-American War, made a deeper impression upon our Volunteer officers, the disgraceful unsanitary conditions and dire consequences would not have been observed."¹

1. At the date of writing this review of General Sternberg's work (May, 1918) I was glad to learn from a surgeon, passing through Washington on his way to the battlefield of Europe, that only a short time before he had heard a surgeon in giving a lecture to the new officers in camp refer to General Sternberg as authority for the statement that the common house fly was without doubt responsible for carrying the germ of typhoid fever, and giving the same instructions contained in General Sternberg's circular.

CIRCULAR NO. 3

Surgeon-General's Office,
Washington, May 18, 1898.

For the information of chief surgeons in organizing the Medical Department and Hospital Corps of their commands, the following relating to the duties of medical officers in the field is published.

Duties of Chief Surgeons of Corps — The chief surgeon of a corps is held responsible for the proper and effective management of the medical service of the command.

He should keep a register of the medical officers and hospital corps, making assignments and issuing orders and instructions with the approval of and "by order" of the Major-General commanding, if authorized to do so. He should make himself acquainted with the sanitary conditions affecting the troops, the efficiency of the field hospitals and of the ambulance companies, and should call for weekly reports of sick and wounded and of the personnel and means of transportation of the hospital corps. All reports and papers not requiring special action should be checked off and receive the stamp of his office before transmittal. Such papers include personal reports of medical officers, monthly reports of sick and wounded, of the hospital corps and of the hospital fund, and sanitary reports from chief surgeons of brigades and divisions; also the lists of wounded called for after an engagement.

A copy of the action taken on all papers referred to him, or forwarded by him should be made in an endorsement book. Such discharge on account of disability, requisitions for medical and hospital, and hospital corps supplies, and all recommendations or complaints referring to the medical service or affecting the health and well being of the troops.

Copies of orders and letters should be made and placed on file, and all circulars and orders from the Surgeon-General or the chief surgeon of the army should be published without delay to the chief surgeons of divisions.

Prior to a movement, the chief surgeon should verify, by personal inspection, the condition of the hospital and of the hospital corps companies and their trains, and should make all the arrangements needful for the probable exigencies of the campaign. He should see that the assignments by chief surgeons of divisions to positions on the operating staff of the field hospitals include the best surgical skill of each division. On the march, he should accompany the staff and acquaint himself with the topography of the country; and when an engagement is imminent he should indicate to chief surgeons of divisions the localities best suited for the establishment of field hospitals. He should inspect these from time to time and exercise general

supervision over the first aid and ambulance stations and the movement of the wounded to the hospitals. He should also supervise the movement of the sick and wounded to the base or general hospitals, providing transportation and detailing medical officers and attendants for their care. When absent on such duties he should leave a competent medical officer with the staff to represent him and to inform him of important changes in the military conditions.

The commanding general should be kept informed of the work of the Medical Department and should always be consulted in matters of importance.

Duties of Chief Surgeons of Divisions: The chief surgeon of a division supervises the medical and hospital corps service of the division. He should transmit official reports and papers with the stamp of his office if routine in character, or with his views endorsed thereon if the subject appears to call for this action. He should have frequent personal communication with the chief surgeon of the corps, and should endeavor to carry out the views of the latter on behalf of the troops. His usual position is with the staff, but he should make frequent visits to the division hospital and the ambulance company, to oversee their work. He should detail one medical officer in rotation as officer of the day, who, on the march, should keep him informed of any noteworthy occurrence, and who in camp should visit each regiment of the division to report on its hygienic and sanitary conditions. Before an engagement he should see that the field hospital is properly established and that the operating surgeon and their assistants are at their proper stations. During and after the engagement he should supervise the movement of the wounded from the ambulance stations to the hospitals.

Duties of Chief Surgeons of Brigades:—The chief surgeon of a brigade is the adviser of the commander in all medical and sanitary questions concerning the command. He should call for a weekly (or daily as may be required) report of sick and wounded from regimental surgeons, and of the detailed members of the hospital corps on duty with them. He should forward the formal reports of these surgeons, and promulgate orders from brigade and higher authorities. He should keep careful watch over the health of the brigade, reporting in writing from time to time, as may be required, and consulting in emergencies with the chief surgeon of the division.

During and after an engagement he should supervise the work at the first-aid stations and the removal of the wounded to the ambulance stations, unless on account of his superior ability he has been assigned to duty at the operating tables, in which case a competent officer should be detailed to represent him temporarily on the staff of the brigade.

Duties of Regimental Surgeons:—The regimental surgeon is in sanitary matters the adviser of the regimental commander. On the march and in camp he should examine the sick with a view to their proper treatment and disposition. He is responsible for any unexpendable medical and hospital property issued for the use of the regiment. His supplies of medicines, etc., should be renewed by requisition on the surgeon in charge of the hospital. Members of the hospital corps on duty with the division are detailed on duty with him. Daily, after sick call, he should send a morning report of sick and wounded and of the hospital corps to the regimental commander, with a duplicate to the chief surgeon of the brigade. He should keep a register of sick and wounded and a retained copy of the monthly report forwarded through the offices of chief surgeons to the Surgeon-General, cases treated in the division field hospital should be borne on this report as so treated. He should forward monthly or when his official station has been changed a personal report on a memorandum slip. After every engagement a list of wounded of the command should be forwarded. If the regimental surgeon is, by order of the chief surgeon, placed on temporary special duty, the senior medical officer with the command will perform the duties of the regimental surgeon. During an engagement he should serve at the first-aid stations.

Duties of Surgeons in Charge of Division Hospitals:—The surgeon in charge of a division hospital is responsible for the care of the sick and wounded on the march and in camp, and for the comfort and general welfare of the wounded when brought to the hospital by the ambulance service. He should direct the unpacking of the wagons for the establishment of so much of the hospital as may be necessary, and the subsequent repacking when the march is to be resumed. He should superintend the admission, return to duty, or transfer to base hospitals of his patients. As commanding officer of the hospital corps detachment he should keep the accounts of the enlisted men on duty at the hospital. He should make timely requisitions for medicines, medical and hospital stores, supplies and property, for the care, expenditure, and use of which he is held responsible. He should supply regimental and other medical officers of the division with such articles as may be required and are available for the treatment of the sick. He should send a daily report of sick and wounded and of the hospital corps to the chief surgeon, and transmit to the Surgeon-General similar reports for the month with a statement of the hospital fund. After an engagement he should forward lists of wounded, and on sending patients to base hospitals he should furnish transfer lists to the senior surgeon accompanying them. Medical officers may be assigned to assist him in the manage-

ment of the hospital. One of these should act as executive officer, aiding the surgeon in charge in the work of supervision, and having special charge of records. Another should superintend the cooking and diet of the hospital, drawing rations from the subsistence department, and issuing them for use and keeping the accounts of the hospital fund. He should also have special charge of the hospital stores, and of such articles of property as are connected with the cooking and serving of food. Others should be assigned as attending surgeons to care for the sick on the march and in camp, and during an engagement to look after the management of the wards, and to make notes of operative procedures, deaths, and of the progress of cases for subsequent report to the surgeon in charge and entry on the records of the hospital.

Duties of Medical Officers in Command of Ambulance Companies:—The medical officer, in command of the ambulance company, is charged with the care of the pay, clothing, and subsistence of his men, and is held responsible for the care of ambulances and other wagons, tents, horses, mules, forage, etc. His subaltern officers assist him in the discharge of these duties. During and after an engagement he is responsible for the safe and speedy transportation of the wounded on litters and in ambulance wagons from the field to the hospital by way of the first aid and ambulance stations, which latter he should organize. Medical officers of the Volunteer Army should make themselves familiar with the provisions and requirements of the manual for the Medical Department, the paragraphs of Army Regulations relating to the Medical Department, the Drill Regulations for the Hospital Corps, and the chapters in Part 1 of the Handbook for the Hospital Corps, by Deputy Surgeon General Charles Smart, U. S. Army.

CONTRACT SURGEONS

But to resume from General Sternberg's report on medico-military affairs:

The large number of sick that had to be cared for during the progress of the war in regimental, division and general hospitals, rendered imperative the employment of additional medical assistance and under the provision of the Act approved May 12, 1898 the services of over 650 contract surgeons were engaged.

Most of the doctors from civil life did good service, many of them were thoroughly equipped physicians and surgeons, with ample hospital experience, but it was impossible to make careful personal selection, owing to the great pressure of business of the office. Since it was impracticable to have the qualifica-

tions of each passed upon by an examining board, I endeavored as far as possible to obtain satisfactory professional endorsements before authorizing contracts.

THE HOSPITAL CORPS

April 25, 1898, in connection with the call of the President of the United States for 125,000 volunteers, I recommended that the law restricting the number of hospital stewards to 100 be changed, and that for each regiment of volunteers, infantry or cavalry, there should be enlisted one hospital steward, one acting steward, and five privates; and for each division of the Army one hospital steward, one acting hospital steward, and fifty privates to serve under the direction of the Chief Surgeon of the division. These recommendations were acted upon favorably in so far that by the Act approved from June 2, 1898, Congress suspended during the existing war all provisions of law limiting the number of hospital stewards at any time to 100, and requiring that a person to be appointed a hospital steward, shall first demonstrate his fitness therefor, by actual service of not less than twelve months as acting hospital steward, provided that the increase of hospital stewards under this Act shall not exceed 100. In addition to the 200 stewards thus authorized, each volunteer organization received into the service, was allowed one hospital steward for each battalion (Act approved April 26, 1898). There was, however, no provision made for Hospital Corps men for volunteer troops, except that which empowered the Secretary of War (Act of March 1, 1897) to enlist as many privates of the hospital corps as the service may require. In order to provide this Corps with the necessary number of men, letters were sent to the superintendents of training schools for male nurses in the prominent cities, advising them of the need of desirable men and asking their assistance in securing unemployed nurses. A number of medical students, pharmacists, and young graduates in medicine enlisted in the Hospital Corps for service during the War, and it is believed that the efficiency of the Corps was thereby raised considerably.

Recommendation was made May 14, 1898 that mustering officers be instructed to enlist desirable men approved by medical officers at the rate of five for each battalion, and subsequently that these be permitted to accompany the regiments on their future service. This recommendation was reiterated June 18, in a communication to the Adjutant-General. Meanwhile, General Order No. 58, Headquarters of the Army, Adjutant-General's Office, May 31, 1898, authorized the transfer of men from the line of volunteers to the Hospital Corps of the Regular Army, upon the recommendation of the Chief Surgeon, and suspended the provisions of Army Regulations governing the

Hospital Corps, so far as they were inapplicable in time of war and with troops in the field. Commanders of corps and of independent divisions and brigades were charged with the full control of the transfer from the line, and enlistment and discharge of members of the Hospital Corps, the detail of acting hospital stewards and appointing of stewards; the latter were limited by subsequent orders to ten stewards for an army corps in addition to those authorized for the volunteer regiments. Authority for immediate enlistments without reference to this office, except in cases where slight defects existed, was also given to a number of chief surgeons.

FEMALE ARMY NURSES

The number of men enlisted and transferred to the Hospital Corps was approximately 6,000, but owing to the limited appropriation, the body of trained hospital corps men was not sufficiently large, and this necessitated the detail of enlisted men from the regiments for hospital duty in several of the camps, and the employment of trained female nurses in general hospitals. Foreseeing the necessity for a large force of the latter class, I applied to Congress, April 28, 1898, for authority to employ by contract as many female nurses as might be required during the war at the rate of \$30 a month and a ration, the pay proper to be paid from the appropriation for the Medical and Hospital Departments. This was promptly granted.

About the same time the National Society of the Daughters of the American Revolution offered its services as an examining board for female nurses, and a committee of which Dr. Anita Newcomb McGee was chairman was designated to take charge of this work. Thereafter most of the female nurses employed were selected by this committee, with the exception of those immune to yellow fever, who were recruited in New Orleans, and other Southern cities. A few were enrolled at Montauk Point, Long Island, and Jacksonville, Fla., by the chief surgeons of those places. A number of patriotic societies offered to provide the hospitals with nurses, but the committee referred to answered its purpose so well, that I did not feel the need of additional assistance and was relieved from what would otherwise have been a serious responsibility. Over 17,000 female nurses have been employed, at first in the general hospitals, and later at field division hospitals, when it became evident that the field service purposes, for which the latter had been organized would have to give place to the imperative need of caring for the many sick men coming from the regimental camps. These hospitals ceased to be ambulance hospitals and their character of fixed hospitals was promptly recognized by assigning contract surgeons and nurses to duty with them, and

providing them with articles of equipment which cannot be carried in the hospital wagons of a marching command.

Female nurses were not sent to these field hospitals, until their original function as an essential adjunct to the command mobilized for active service became lost in the current of immediate necessities. Many of the trained nurses were Sisters of Charity, whose services were highly appreciated by medical officers in charge, as well as by the individual sick men, who benefited by their ministrations. Others were obtained through the kind assistance of the Red Cross Auxiliary No. 3, specially organized for the maintenance of trained nurses, and I desire to express my high appreciation of the valuable services rendered to the Medical Department by this organization.

MEDICAL AND HOSPITAL SUPPLIES

The authorized strength of the Army April 1, 1898 was a little over 28,000 officers and men. This force was stationed as garrisons at military posts and while the supplies furnished were more especially adapted to the medical wants of troops in service under such conditions, there was ample provision for field service, especially at posts where active service against Indians or on riot duty was possible.

Further than this, it is believed the available medical supplies were sufficient for the then existing army for any duty, though necessarily additions would have to be made in mobilizing for foreign service. Up to the time war was declared, it was not practicable to take any immediate steps to obtain supplies owing to the wording by Congress of the appropriation bill and hence there was no money available from which to make purchases. But immediately after the war was declared and money became available many medicines were purchased in the open market, but a great number of articles indispensable to an effective service in camp or field, could not be readily obtained in the open market. This was especially true of medicine chests and apparatus, surgical instruments, hospital tents, and furniture. I repeat what has been asserted that "If the wording of the Act of Congress had permitted the War Department to make use of some portion of the \$50,000,000 for offensive preparation, much could have been accomplished between March 9 and April 23 in the way of getting ready for the impending conflict. It will always be a subject of regret that the bill did not grant this privilege.

But already before April 1, in view of the possibility of future needs, orders were given to have the field medical outfits, medical and surgical chests, instruments, etc., at the supply depots put in order for issue immediately in case of need, and

early in March the preparation of new pattern medical and surgical chests was begun so as to have them ready for manufacture should the necessity arise.

Immediately upon the declaration of war, April 21, steps were taken to obtain medical supplies for the new volunteer army. For the more important articles, and those of highest cost, bids were invited at short notice, such, for instance, as medical and surgical chests, litters and slings, field operating cases, pocket-cases, orderly and hospital corps pouches, etc. Orders were given and the manufacture expedited with the utmost dispatch.

Requests for proposals for the usual spring purchases had been made in March, but to obtain medicines and other additional supplies, in view of a state of war, advantage was taken of authority granted by Act of Congress and purchases were made in open market, the interests of the Government being guarded by obtaining informal bids when the amount was large and time permitted.

May 3, foreseeing that it would be impossible to have ready for issue to the volunteer regiments, as soon as they were mustered in, the medical and surgical chests above referred to, as well as other articles of field equipment, although their preparation was pushed with the utmost dispatch, I telegraphed the governors of the several states for authority to utilize the medical equipment of the National Guard in the service of the state volunteers, until our Army medical supplies were ready for issue. Most of the governors of the states who had field equipment responded promptly and satisfactorily, but unfortunately many of the state medical departments had no such equipment. These deficiencies were supplied by the issue of the advance field regimental outfits, referred to hereafter. Most of the state field medical equipment so loaned has been, or probably will be, eventually paid for by the United States.

Meanwhile the officers in charge of the medical supply depots in New York and St. Louis were directed to make arrangements so that supplies could be immediately obtained for 100,000 men for six months. As the supply table published in 1896 was prepared for garrison use in time of peace and was inappropriate for use of troops in the field, a field supply table was prepared and approved by the Secretary of War, May 9, 1898.

This supply table specifies the contents of the medical and surgical chests, the hospital corps and orderly pouches, field operating surgeons, field and pocket-cases, mess chests, and field desk, and gives the allowance of medicines and disinfectants, hospital stores, stationery, furniture, bedding, clothing, and miscellaneous articles for field hospitals and ambulance

trains. It was intended to provide for the needs of commands in active service where only a limited supply of articles could be carried owing to the necessity of restricting transportation.

But as soon as it was evident that the troops were likely to be retained in camps of instruction, notification was given that articles on the regular supply table could also be obtained. August 12, in Circular No. 6, from this office, I again called attention to this subject, directing chief surgeons of army corps, of divisions, and of smaller commands to make timely requisitions for supplies by telegraph if necessary, and to see that field hospitals in which typhoid fever and other serious cases were treated were liberally supplied with disinfectants and all articles necessary for the treatment and comfort of the sick.

New forms of surgical dressings especially designed for field use composed of sterilized, sublimated and iodoform gauze; sterilized gauze bandages, absorbent cotton, catgut and silk, sterilized and packed in convenient envelopes, compressed cotton sponges and plaster of Paris bandages were also prepared under the immediate supervision of this office. Samples of these were sent to the three supply depots, New York, St. Louis and San Francisco, and all issues directed to be in conformity therewith. Forty boxes of these specially prepared dressings were put up at the temporary supply depot, Army Medical Museum, Washington, D. C., and sent to Tampa, Fla., for use of the army about to sail for Cuba.

To provide temporarily for volunteer regiments organized and ordered to camps before the new medical and surgical chests were ready for issue, supplies of medicines, instruments, hospital stores, stationery and miscellaneous articles, according to the prescribed list and packed in convenient boxes were prepared at the supply depots. An important article to be provided was the "first aid packet," containing antiseptic dressings for immediate use in emergencies and intended to be carried by each individual soldier. These were promptly and liberally supplied.

Whenever notice was received from the Adjutant-General's Office that commands were to be moved or camps formed, I endeavored to anticipate the wants of the troops by telegraphing the officer in charge of the nearest supply depot to forward supplies for the stated number of men according to the field supply table. Requests from medical officers for supplies and orders based thereon transmitted to the supply depots were largely by telegraph, and orders were given when the supplies were needed promptly they should be forwarded by express to their destination. When a medical officer desired to purchase medical and other supplies for use in emergencies, authority to do so was always granted. Extensive purchases of medical supplies were made direct from this office from dealers in Wash-

ington, Baltimore, and Philadelphia to provide for the immediate wants of troops at Camp Alger, Va., and the general hospitals at Fort Myer, Va., Washington Barracks, D. C. and Fortress Monroe, Va. This was done not only to meet with promptness the urgent needs of troops and hospitals in the vicinity, but to relieve somewhat the great pressure upon the supply depot at New York.

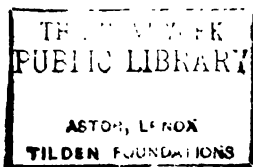
In addition to the field supply table issued May 9, 1898, a revised edition of the Manual for the Medical Department was published. These, together with the 2,400 copies of a revised edition of Lieutenant-Colonel Smart's Handbook for the Hospital Corps, were freely distributed throughout the Army, so that medical officers might become acquainted with the proper mode of obtaining supplies and their many other important duties. It is impossible to give a full list of medical supplies that were provided, but the following list will give an idea of the amounts of some of the principal articles.

First-aid packets.....	272,000
Orderly pouches	5,797
Pocket-cases	509
Surgeon's field cases.....	962
Field operating cases.....	369
Medical and surgical chests.....	328
Litters	1,204
Litter slings.....	2,259
Cots and bedsteads, with bedding.....	7,600
Blankets, gray.....	18,185
Field desks.....	440
Quinine pills.....	7,500,000
Chloroform and ether bottles.....	13,220
Gauze, sublimated, packages.....	100,625
Gauze bandages, 3 sizes, 1 meter packages	331,776

The medical supply depot in New York, Lieut.-Col. J. M. Brown in charge, supplied the posts in New England, the Middle States, and along the Atlantic Coast including Florida, and the troops that have been sent to and are now serving in Cuba and Porto Rico. Ordinarily requisitions received from officers serving in the localities mentioned were acted on and sent by the next mail to the depot for issue, but as already stated the telegraph and express companies were brought into use where the necessity called for prompt action. The pressure on this depot was at times extremely great in supplying the troops sent to Cuba and Porto Rico, and the large camps at Falls Church, Va., Middletown, Pa., Hempstead and Montauk Point, N. Y., and Jacksonville, Fernandina and Miami, Fla. On account of the great urgency attending the establishment of Camp Wycoff the officer in charge of the New York supply



United States General Hospital, Fort Myer, Va., 1898.



depot was directed to honor all requisitions made by the chief surgeon at Montauk Point without referring them for approval of this office.

The medical supply depot at St. Louis, Mo., under charge of Col. J. P. Wright, Assistant Surgeon-General, supplied the states of the Mississippi Valley and region east of the Rocky Mountains, including Texas. The large camp at Chickamauga was supplied entirely from this depot, together with the camps at Knoxville, Tenn., Lexington, Ky., Anniston, Huntsville and Mobile, Ala., and New Orleans, La. Many articles were sent from this depot to the supply officer at San Francisco, Calif., for the use of the Philippine expeditions. Owing to the distance of the camps at Lexington, Knoxville, Huntsville and Anniston from Washington, the chief surgeons of these several camps were authorized to draw upon the depot at St. Louis for any article on the supply table without submitting requisitions in advance to this office. The officers in charge of the depots at New York and St. Louis were directed July 8, to keep in stock 1,000 iron beds or cots, with a full supply of bedding, ready for immediate issue.

The responsibility of supplying the posts on the Pacific Coast and of outfitting the troops leaving for the Philippine Islands was placed upon Lieut.-Col. J. V. D. Middleton, Deputy Surgeon-General in charge of the supply depot at San Francisco, Calif. As much delay and expense of transportation would have been incurred by sending supplies from Eastern depots to San Francisco, Colonel Middleton was authorized to purchase at discretion all necessary medicines, hospital stores, instruments, and miscellaneous supplies of every kind needed for the troops going to Manila. Articles of special manufacture, such as medical and surgical chests, litters, and litter slings, hospital corps and orderly pouches, and the specially prepared field dressing, already referred to, were shipped to San Francisco from St. Louis, not being obtainable on the Pacific Coast. The distance of San Francisco from the center of the Government was so considerable that the officer in charge of that depot was necessarily given large discretion in the purchase of supplies and expenditure of funds. Lieut.-Colonel Middleton deserves great credit for the efficient service rendered by him both as medical supply officer and as Chief Surgeon of the Department of California.

RAILROAD AMBULANCE TRAIN

A railroad ambulance train was in my opinion essential to the well-being of the sick and wounded during transportation from Tampa, Fla., the probable base of operations in Cuba, to general hospitals in the interior. Accordingly, May 30, 1898, I recommended the equipment of a train to consist of ten tourist

sleepers and a dining car. This was approved, and June 16, I was informed that a train of ten Pullman sleepers, a dining car, a private car, and a combination car was ready for service. The train was inspected by Maj. Charles Richard, Surgeon, United States Army, who was placed in command; one assistant-surgeon, two stewards, twenty privates of the Hospital Corps, and three civilian employes were assigned to him for service. The train was amply provided with all the medicines, hospital stores and comforts required for the patients to be transported. The first trip made was from Washington, D. C., to Tampa, Fla., for the purpose of transporting sick from the latter place to general hospital at Fort McPherson, Atlanta, Ga. Tampa was reached June 19; Fort McPherson June 22. Here the Pullman cars were exchanged for the tourist sleepers originally requested. The latter were much better adapted for hospital purposes on account of their general arrangement, better ventilation, and convenience for cleanliness and the handling of patients. They had 134 lower and 136 upper berths, giving a total carrying capacity of 270. It was impracticable, however, to use the upper berths for severe cases on account of the impossibility of giving proper care and attention to such patients occupying them.

Several trips were made between Tampa and Atlanta, on each of which great delay was encountered involving inconvenience and anxiety to all concerned, and discomfort and even harm to the sick was occasioned by the difficulty of obtaining a prompt response from local quartermasters to requisitions for the necessary transportation. On one occasion, after a delay of twenty-four hours, telegraphic communication with Washington had to be established before a movement was made. However, July 4, Capt. H. R. Stiles, Assistant Surgeon, United States Army, on duty with the train, was appointed an acting quartermaster with authority to issue transportation requests. Major Richard reported on this as follows:

"Not only has this change given me more time to attend to the more important functions of my charge, and has avoided many vexatious delays, but it has enabled me to come in direct communication with the railroads, and a better understanding is reached regarding speed, routes, and care of train en route, all of which factors should be considered in a service which has for its object the comfortable and rapid transportation of the sick and wounded."

July 9, the hospital train met the transport *Cherokee* at Port Tampa, Fla., on her return from Santiago with 323 sick and wounded, removed 87 that same night to the hospital on Tampa Heights, and on the following day left for Atlanta with 235 patients. This number together with the hospital corps detach-

ment and civilians taxed the capacity of the train to its utmost, especially in the way of serving meals; but all wants were fully supplied. During this trip, while the engine was taking on water, the hospital train was struck in the rear by a passenger train. A caboose on the rear train was completely shattered; the private car used by the medical officers was so badly injured as to necessitate its abandonment, and many of the platforms were splintered, while the sick and wounded were severely shaken up by the collision, but fortunately no serious casualty resulted. Up to August 31, the hospital train had run 17,500 miles and transported 1,923 patients with only four deaths. Notwithstanding the large number of typhoid cases transported and the difficulty of handling such cases on this train, disinfection was so efficiently carried out that no cases of this disease occurred among the personnel of the train. The utmost care was given to the disinfection of excreta to prevent any danger of the dissemination of this disease during the transportation of the sick.

HOSPITAL SHIPS

April 15, 1898, General Sternberg applied for a ship to be used as a hospital ship. After an inspection had been made of various ships offered, he recommended, April 23, the purchase of the S.S. *John Englis* as well adapted for the purpose in view—a floating hospital for the care of the sick and wounded. It was to serve at any point on the Cuban coast for the transportation of the sick to any other point on our own coast and to act at the same time as a depot of reserve medical supplies for troops in the field.

This recommendation was not approved at the time, and various other ships were inspected, but none found to be suitable. May 18, by direction of the President, the *John Englis* was purchased, and the Quartermaster's Department took charge of her to prepare her for the special service required. Maj. George H. Torney, Surgeon, U. S. Army, was directed to make recommendations with reference to necessary alterations and apparatus, and was subsequently placed in command of the ship. The work necessary to make the vessel serviceable for the purposes in view required much more time than was at first anticipated, as may be gathered from a note written by General Sternberg to Major Torney, June 12:

The hospital ship will be required at the earliest possible moment to go to Santiago, where you are likely to have plenty

of sick and wounded men awaiting your arrival. I trust that you will do every thing in your power to have the ship ready for orders at the earliest possible moment. Be sure to get everything on board as soon as possible, for when you get your orders we want no delay on the ground that certain articles for which requisitions have been made are not yet on board ship.

June 22, he again wrote:

You will do everything in your power to expedite the work upon the hospital ship *Relief*, and when she is ready for sea, report to me by telegraph. Upon receiving telegraphic orders to that effect, you will proceed directly to Santiago de Cuba, reporting your arrival to the Commanding General at that point. Your ship should be anchored in a safe harbor at such point as may be designated by the proper authorities, and as near as possible to the seat of active operations. You will receive on board up to the full capacity of the ship the sick and wounded of the Army and Navy and care for them exactly as if they were in a general hospital, and you will be expected to make such reports and returns as are required by regulations for a general hospital.

Your attention is especially invited to Army Regulation 1433, and should anyone attempt to exercise unauthorized authority over you or your ship, you will invite their attention to this regulation. When in your judgment or that of the commanding general or the chief surgeon of the troops at whatever point you may be located, it is desirable that you should proceed to a home port for the purpose of landing the sick and wounded, you will, if practicable, communicate with me by telegraph, and orders will be sent you designating the port for which you should sail. If it is not practicable to communicate with me by telegraph, you should apply to the commanding general of the troops for orders to proceed to such home port as may be desirable and immediately upon your arrival you should communicate with me by telegraph in order that arrangements may be made to transfer the sick and wounded to a general hospital. You will issue medical supplies upon properly approved requisitions to troops in the field and will do everything in your power to aid the medical officers with the troops, in providing for the comfort of the sick and the issue of ice, hospital stores, and such delicacies as you may have at your disposal. When practicable, you will send to me once a week a telegraphic report showing the number of patients of the Army and of the Navy on board the hospital ship. You should make timely requisition for necessary supplies for use on the ship and for issue to the troops in the field.

Further instructions were sent June 27 :

You should keep in view the fact that the *Relief* is a well-equipped floating hospital and a depot of supplies for troops in the field. It is important, therefore, that she should not be taken away from the scene of active operations unless it is absolutely necessary for the purpose of landing the sick and wounded at a home port. You should avail yourself of every opportunity to send proper cases by the navy ambulance ship *Solace*, or by army transports returning to home ports. As a rule, the more serious cases of injury and sickness should be retained on your ship, as the disturbance incident to a sea voyage would be injurious to them. Convalescents and those sick and wounded who can be transported without injury to themselves, and who are not likely to be fit for duty within a short time, should be sent to a home port, whenever an opportunity offers.

Further particulars regarding our first hospital ships are contained in General Sternberg's report :

The *Relief* sailed from New York, July 2, and arrived at Siboney on the 7th. She left Siboney July 19, with 254 sick and wounded and arrived at New York on the 23d. She sailed for Ponce, Porto Rico, August 3, and returned to New York on the 19th with 255 sick and wounded. The vessel made another trip to Ponce, Porto Rico, returning with sick, September 6, to Philadelphia, whence she went to Montauk Point to transport sick to hospitals in Boston and Philadelphia. Another trip to Porto Rico was then made, the vessel returning, October 11, to Fortress Monroe, Va.

July 1, 1898, Mr. N. B. Baker, President of the Atlantic Transport Line, Baltimore, Md. tendered the S.S. *Missouri*, with her captain and crew to the Government as a hospital ship. This generous and patriotic offer was accepted by the Secretary of War and Maj. W. H. Arthur, Surgeon U. S. Volunteers (assistant-surgeon U. S. Army) was ordered to take charge of her preparation for service and subsequently to command her. It was recognized that considerable refitting would be required before the vessel could be utilized. Ten days or two weeks was the period estimated as needful to permit of making the necessary alterations and providing the vessel with a steam laundry, steam sterilizing apparatus, and ice and carbonating plants, but it was not until August 23 that the ship was reported ready to sail, and even then a good deal of work had to be done on board during the stormy passage to Santiago. She returned from Cuba with 256 sick men, who were landed at Montauk

Point. Her second voyage was to Porto Rico, whence she brought 270 patients to the "Josiah Simpson Hospital," Fortress Monroe, Va., on October 6th.

The hospital ship *Olivette* was a steamship which had been doing service as a water boat for the fleet of transports when Lieut.-Colonel Pope, Chief Surgeon of the Fifth Army Corps selected her for use as a hospital ship during the voyage from Tampa, Fla., to Santiago, Cuba. The equipment of one of the field division hospitals of the Corps was used in outfitting her for the work. On the arrival of the fleet at Daiquisi, she relieved the transports of their sick, many of whom were later transferred to the steamer *Iroquois*, so that room was made on the improvised hospital boat for the wounded expected from the impending battle. The *Olivette* answered her extemporized purpose excellently. She left Santiago July 9, with 279 wounded officers and men and reached New York on the 16th. She returned to Santiago with medical supplies for the troops, and August 15 sailed with 203 sick men, who were distributed in Boston city hospitals. The *Olivette* sailed August 25 from Boston under order for Fernandina, Fla., for the purpose of bringing sick back to the general hospital at Fortress Monroe, Va. August 31, while coaling in stormy weather off quarantine at Fernandina, she listed heavily, filled with water, and sank in 20 feet of water. No loss of life occurred.

THE HEALTH OF THE TROOPS

Promptly following the declaration of war, arrangements were made by the War Department to recruit the Regular Army to its war strength, and to muster in the volunteer troops called out by the proclamation of the President. The Regular Army at that time consisted of well developed men, sound in physique, and well drilled and disciplined. In its ranks were only about forty boys under 21 years of age enlisted as musicians; but when recruiting was begun the minimum age for enlistment in the regulars was reduced to 18 years, and the boys of this age were accepted for the volunteers. *In my opinion this reduction of the age limit had a notable influence in increasing the prevalence of diseases among the troops.* All military experience shows that young men under 21 years break down readily under the strain of war service, and every regiment had many of these youths in its ranks.

I am of the opinion also, that the haste with which the volunteer regiments were organized and mustered into the service was responsible for much of the sickness which was reported in the early days of their camp life. Medical examiners were appointed to testify to the physical qualifications of each man before acceptance, but notwithstanding this, which at the time was characterized in the press as a very

rigorous procedure, so many men were afterwards found on the sick lists of the camps unfit for service from causes existing prior to enlistment, that special arrangements had to be made for their discharge.

PRIMARY CAUSES OF SICKNESS

Soon after the newly raised levies were aggregated in large camps, sickness began to increase progressively from causes that were so general in their operation that scarcely a regiment escaped from their harmful influence. These causes may all be referred to ignorance on the part of officers of the elementary principles of camp sanitation, and of their duties and responsibilities as regards the welfare of the enlisted men in their commands.

Officers who were responsible for the clothing and equipment of their men, for their shelter, drill, discipline, and personal cleanliness — in fact, for their comfort, well-being and sound physical condition, were to a large extent ignorant of how to act in order to sustain their responsibilities, and others were even ignorant that these responsibilities rested on them. Medical officers, as a rule, were almost without experience in the sanitation of camps and the prevention of disease among troops. The few who knew what should be done were insufficient to control the sanitary situation in the large aggregation of men hastily gathered together. As a result officers and men appeared to me to have regarded the deplorable insanitary conditions under which they live in their camps of organization, as the inevitable conditions of camp life preparatory for field service, and to have accepted them without question until general attention was attracted to them by an outbreak of typhoid fever. Officers and men in these camps were ripe for war, and drill, and parade, practice marches and military camp duties occupied the whole of their time and energies. Domestic economy and sanitation in companies and regiments were not given proper consideration, and men who were being taught to meet the enemy in battle succumbed to the hardships and insanitary conditions of life in their camps of instruction.

The sites of certain of the camps have been instanced in the newspapers as the cause of the sickness that was developed in them. It is true in some localities, the sinks could not be made of the proper depth on account of the underlying rock; in others a substratum of impermeable clay, and in others again a high level of subsoil water interfered with a satisfactory condition of the sinks. At Miami, Fla., the water supply was generally regarded as not good, and at Camp Merritt, Calif., the climatic conditions were such as to lead to its speedy abandonment. But these were local conditions, while the sickness which invaded the camps was general in its onset. A review of the

whole situation shows that it was not the site but the manner of its occupation which must be held responsible for the general spread of disease among the troops.

OVERCROWDED CAMP SITES

The primary evil was overcrowding the site. The aggregation of troops was effected hastily. On his arrival at Camp Alger the medical officer assigned to duty as chief surgeon found a number of regiments in camp. "Troops were arriving with every train, generally without previous announcement, and these camped where they saw fit." As a general hygienic as well as a military principle, troops in the field should encamp in rear of their color line. The area occupied as a camping ground should be as wide as the color line is long. This gives wide streets, ample space for the separation of tents, and a front which affords room for the needful sink accommodation. But no principle of this kind was manifest in the regimental camps of the newly organized commands. On the contrary, the idea seemed to prevail that the troops should be compacted as much as possible. Both at Alger and Chickamauga the companies of a regiment were crowded on an area insufficient for those of a battalion, and brigades were packed together with scarcely an interval between the regiments.

Lieutenant-Colonel Smart, in his inspection of Camp Alger, found company streets hardly wider than the intervals between adjacent companies should have been, and tents of the same company in contact with each other on the sides, and in contact on the ends with those of the adjoining company, so that the double row of tents between the narrow company streets made a continuous canvas covering 70 to 80 feet long and 16 feet wide, under which 100 men had to find shelter. Even when space was allowed between the tents of the same adjacent companies, it was wholly insufficient for proper trenching, ventilation and passageway. With streets reduced in some instances to a width of only 13 feet, the natural surface of the ground with its matting of grass roots is speedily eroded and the camp surface converted into a layer of dust or mud, according to the character of the weather. This constitutes a serious evil, but the great sanitary objection to crowding the area in this way, is that the slops and garbage of the kitchens and the excreta of the sinks are too near to the quarters of the men. Fecal odors were perceptible in many of the camp streets, and of certain regimental camps it is reported that their odors were in themselves a veritable nuisance. The contracted front of the camp gave no room for a sink of the proper size for each company. A battalion of troops had to use a sink insufficient to accommodate a company. It was impossible to keep these pits in good condition when used by so many men. Covering

the excreta at regular intervals was unsatisfactory, as fresh deposits were made while the police party was at work. Efforts were made to remedy this by requesting the individual man to cover deposits as soon as made. There was no room for the only efficient remedy, a sufficient number of properly constructed and well cared for sinks, 150 yards in front of the color line, or at a corresponding distance on the flanks of the camp. These small sinks had the further disadvantage that they were filled up almost as soon as dug and had to be replaced by freshly dug pits, so that in a short time the whole of the contracted front of the camp was converted into sink surfaces.

INSANITARY CAMP SITES

April 25, 1898, foreseeing the likelihood of insanitary conditions in the camps of our newly raised troops, and with the view of preventing them, I issued Circular No. 1 from this office impressing upon medical officers their responsibility in sanitary matters and the necessity for a strict sanitary police, particularly in the care of the sinks and in the preservation of the camp area from contamination. These lessons should have been heeded, but the density of the military population on the area of these contracted camps prevented the possibility of a good sanitary condition. Camps of this character may be occupied for a week or two at a time without serious results, as in the case of national guardsmen out for ten days field practice during the summer, but their continued occupation inevitably results in the breaking down of the command by diarrhea, dysentery, and typhoid fever. [See page 161.]

Not only was the area crowded by the tentage, but the individual tents were overcrowded. Four to seven men were crowded into the small wedge-shaped wall tent which covers an area of only 7 to 8 feet. Some company and regimental commanders encouraged their men to build sleeping bunks or rather low platforms, for the area under canvas would not permit of a separate bunk for each man; others directed the men to carpet the floor of their tents with pine twigs or a layer of bark. Others again had straw littered on the floor; but most of the troops lay for weeks upon the ground, their blankets soiled and matted with dust, and their clothes soiled and dusty, for it was impossible to preserve anything clean under such primitive camp conditions. Facilities for bathing were rarely found in the camps, and laundry and lavatory facilities were not always readily available.

These troops were subjected to most of the discomforts, hardships and climatic exposures inevitable to an active campaign, while nominally enjoying the comforts of a fixed camp of instruction. Only on active service in front of an enemy should it be allowed to have men sleep on the ground for weeks

at a time, under insufficient shelters, and with inadequate facilities for personal cleanliness. On active service many of the insanitary features of their surroundings would have been removed. While campaigning they would have changed camp sites from time to time, and would have been freed from the harmful influence of accumulated filth, while opportunities for bathing would have been presented occasionally in passing or camping near streams. The only explanation that can be given is that the officers, military and medical, having no experience of military life in the field assumed that the deplorable condition in which they were living was the usual mode of life of soldiers situated as they were, and that their duty as true soldiers was to endure not only without complaint but with a certain pride, the hardships of their camp life. Practically nothing was done to make the men comfortable or to remedy the insanitary conditions until these were brought to the attention of the Secretary of War by inspectors sent out by special orders from the War Department. Then the camps held for so long were abandoned, but not before the manifestations of typhoid infection were rife in them. New sites were carefully selected, regimental camps were expanded, company tentage increased, and board flooring provided. Then, for the first time, the troops went into camps suitable for the occasion.

CAMP DISEASES

An increased prevalence of diarrheal diseases was the first manifestation of danger in the early camps. Much of this was no doubt due to the chill of the surface in cooling off after the perspirations attending drills in hot weather, much to the sameness of diet and bad cookery, much to the over-indulgence in fruit of doubtful quality, pies, etc., purchased from peddlers of food and soft drinks, who were established in business in or around most of the camps, and much to similar indiscretions following the arrival of boxes of dainties from friends at home. Chill of the surface was aggravated by the ignorance or recklessness of the men, few of whom appreciated its dangers. The sameness of diet led to criticism of a ration, which is not only more liberal than that of any foreign military service but which sustained the volunteers of the Civil War during their arduous campaigns.

Regimental commissaries and company commanders require experience which few of our volunteer officers possessed. The annual outings of the National Guard, with a caterer to provide special diet for the men, gave no opportunity for line officers to learn how to use fixed rations to the best advantage or to exercise the needful supervision over cooks of doubtful qualifications.

Malarial fevers added to the sick lists of camps in Florida and of Southern regiments in camps in Georgia and Virginia. It was, however, typhoid fever which broke down the strength of the commands generally; the outbreak becoming distinctly manifest in July. Sporadic cases appeared in most of the regiments in May and June, these cases having been brought in many instances from the State camps. In fact, some regiments, as the Fifteenth Minnesota, suffered more from this disease at their state rendezvous than any of the regiments in the large Federal camps. A few of the regimental commands of the latter may be said to have escaped visitation. The sanitary conditions affecting the commands in the various camps have been studied in connection with the prevalence of typhoid fever among the men by a board of medical officers consisting of Majors Reed, Vaughan and Shakespeare, but the results have not as yet been reported in full.

It appears to me, however, from a general review of the sanitary reports already filed, that the prevalence of the disease was proportioned to the insanitary camp conditions which I have described above. My circular No. 1, already cited, was intended to bring the danger from this fever to the notice of medical officers with a view of obviating it. The probability of its communication to soldiers in camp through the agency of flies was pointed out as a reason for insisting on a sanitary police of the strictest character. At the time of the outbreak and rapid spread of the disease all the camps were suffering from what my reports characterized as the "plague of flies." Clouds of these insects swarmed about fecal matter and filth of all kinds deposited on the ground or in cesspools or sinks, and conveyed foul and infectious matter thence to the food exposed while in preparation in the company kitchens or while being served to the men.

It is well known to the medical profession that this fever is propagated by a contaminated water supply, and it is now recognized that the great prevalence of this disease in an aggravated form in the camps of the Civil War was due to the use of surface and shallow well waters infected by typhoid excreta. To prevent transmission by the water supply I recommended the use of boiled water and filtered water when a pure spring supply could not be obtained, and to enable an efficient filtration of suspected waters to be made, field filters of approved construction were issued on my recommendation by the Quartermaster's Department.

Circular No. 4, May 31, 1898, was issued from my office that medical and company officers should have a thorough understanding of the intention and action of these filters and that the full benefit of their use might be secured to the troops.

Chief surgeons were instructed to forward samples of water to this office for analysis, whenever a doubt existed as to its quality, and the water supply of several of the camps was thereafter kept under analytical observation. This care exercised in the exclusion of typhoid infection from the water did much to retard the epidemic progress of the disease.

Regiments camped near each other and using water from the same sources were not equally affected, thus showing that the cause was disseminated in other ways than by the water supply. The disease was slow in its development at Jacksonville, Fla., which had a water supply from artesian wells. But the infection once introduced into a camp, from state rendezvous or by sporadic infection from the neighborhood, began slowly to spread on account of the close contact of the men through overcrowding and bad conditions of sinks.

I shall never forget the many exciting scenes that we encountered in our home during the Spanish-American war. Our country was unprepared for hostilities because of the almost general belief that we would never again be at war and because of our pride as a nation that we never went to war without good and sufficient cause. Our home became as busy as any office. Telegrams came at all hours, the telephone rang almost constantly, and wives and mothers in great numbers sought information regarding husbands and sons. Our evenings at home were no longer for rest and recuperation. My sympathetic husband would see all people who came in distress and he tried to answer all their questions as best he could. He was, however, severely tried when telegraphic messages from the governors of states demanded to know immediately where the state train was and why it was being delayed. These state trains had never been placed under his orders, and he was in no way responsible for their service.

The kindness of President McKinley is one circumstance which stands out in bold relief against the difficulties of those trying days. One day he inquired of General Sternberg why I had not made my usual visits to Mrs. McKinley, and he was informed that I was all broken up over the adverse criticism of the conduct of the war. He told General Sternberg to bring me over, as I evidently needed a lesson in politics. When we met the following Sunday evening, he expressed regret that I should have worried over the newspaper accounts, remarking at the same time, that I did not understand that much of the

criticism was for political effect and that history would reveal that we had all done our duty, and in the meantime we had at least the approval of our conscience.

SANITARY LESSONS OF THE WAR

General Sternberg was naturally very anxious about the health of the troops and was greatly perturbed at the disappointing results of his efforts to secure efficient camp sanitation. No one realized more than he, that typhoid fever and other camp diseases are to a great extent preventable, and hence that much of the sickness and suffering of our troops was cruelly unnecessary. In order to preserve and to transmit to contemporaries and to posterity the knowledge purchased at so vast an expense, he prepared and delivered the following address, which was read before the Section on State Medicine, at the fiftieth annual meeting of the American Medical Association held at Columbus, Ohio, June 6-9, 1899:

As compared with the Civil War and with other great wars during the present century, the mortality from wounds and disease among our troops during the war with Spain has been low. Our wounded have had, to a large extent, the advantage of prompt treatment with antiseptic dressings and a very considerable portion of those who were not killed outright have recovered without any mutilating operation or septic complication. The mortality from disease has also been comparatively low, but unfortunately during the first months of the war, that scourge of new levies of new troops—typhoid fever—prevailed in many of our camps and claimed numerous victims. It is well known to sanitarians and military surgeons that as a general rule more soldiers succumb to disease than are killed by the bullets of the enemy, and our recent war has not been an exception in this regard. The total number of deaths reported in our enlarged army, including regulars and volunteers, from May 1, 1898, to April 30, 1899, is 6,406. Of these, 5,438 died of disease and 968 were killed in battle or died of wounds, injuries or accident. During the Civil War the number of deaths from disease was 186,216.¹ The number who were killed in battle or died of wounds was 93,969, or about one-half of the deaths from disease. The total deaths from disease in the Union armies from the commencement of the war to December 31, 1862, was 34,326, and in the Confederate armies during the same period, 31,238.

¹In addition to this 24,184 deaths are recorded as from unknown causes, and probably most of these deaths were from disease.

The accompanying table gives the monthly death-rates from disease in our armies from May 1, 1898, to April 30, 1899, and, for comparison, the rates for the same period in the first twelve months of the Civil War.

In comparing the death-rates from disease during the year of the Spanish-American War, May 1, 1898, to April 30, 1899, and the first year of the Civil War, May 1, 1861, to April 30, 1862, note should be taken in the first place that the mean strength in May, 1861, was only 16,161, as compared with 163,592 men in service in May, 1898. The mustering in of volunteer troops was slower in 1861 than during the recent war, so that it was not until September and October, 1861, that the mean strength assumed proportions equal to that of corresponding months of the Spanish War. Although the number present in the camps of 1861-1862 after October, 1861, was largely in excess of those aggregated during the past year, the

COMPARISON OF MONTHLY DEATH RATES (PER 1,000) FROM DISEASE

Months	1861-1862			1898-1899		
	Mean Strength	Number of Deaths	Ratio per 1,000 of M. S.	Ratio per 1,000 of M. S.	Number of Deaths	Mean Strength
May.....	16,161	18	1.11	0.25	42	163,592
June.....	66,960	55	0.82	0.43	90	208,237
July.....	71,125	106	1.49	1.70	451	265,529
August.....	112,359	242	2.15	5.13	1,400	272,618
September.....	105,126	865	2.21	5.74	1,541	268,181
October.....	256,884	725	2.82	3.58	809	225,275
November.....	301,848	1,145	3.79	2.08	865	179,186
December.....	343,184	1,471	4.29	1.19	201	168,987
January.....	352,700	1,598	4.52	1.15	180	155,792
February.....	327,734	1,346	4.11	1.30	156	129,758
March.....	323,878	1,575	4.79	1.08	123	113,798
April.....	410,416	1,881	4.58	0.85	80	98,365
Annual.....	229,452	10,522	45.86	27.13	5,438	200,885

average annual strength during both wars did not differ greatly. Nevertheless, the deaths from disease in 1861-62 numbered 10,522, while in 1898-99 they amounted only to 5,438. The death-rate per thousand of strength mounted gradually month by month in 1861-1862, and indeed it did not reach its acme until February, 1863, when the rate of 6.39 was reached. In 1898, on the other hand, the acme, 5.74, was reached suddenly in September, but owing to the sanitary measures adopted, the fall during October and November was as rapid as had been the rise.

The same gradual rise is seen in the mortality statistics of typhoid fever during the Civil War. The highest death-rate, 2.81, was not reached until May, 1862, the thirteenth month of the aggregation of the troops, when 1,092 men died of this disease, and the fall of the rates was as gradual as the rise. On the other hand, the rise in 1898 was sudden, the maximum

rate, 3.57, being reached in September, when 933 men died of the disease; but the fall during the months of October and November was as notable as the rise. This sudden suppression of the disease can not be attributed to an exhaustion of the susceptibility of the troops to attack from this fever, as they only suffered at the rate of 12.37 per thousand of strength during the twelve months, whereas the troops of the Civil War suffered at the rate of 19.71 per thousand. It can be attributed only to the active preventive measures that were instituted, and especially to moving the troops to fresh camp sites and the greater care exercised in the disposal of excreta.

TYPHOID FEVER

The notable rise in the general death-rate from disease, and in that from typhoid fever alone, which occurred in August and September, was undoubtedly due to the insanitary conditions resulting from the hasty assembling of large bodies of undisciplined troops in our camps of instruction.

The average annual mortality from typhoid fever in our regular army since the Civil War has been: for the first decade (1868-1877), 95 per 100,000 of mean strength (.95 per 1000); for the second decade (1878-1887), 108 per 100,000; for the third decade (1888-1897), 55 per 100,000. This latter rate compares favorably with that of many of our principal cities. For example, it is exceeded by the typhoid death-rate in the city of Washington, which is 78.1 per 100,000 (average of 10 years—1888-1897); by that of the city of Chicago, which is 64.4 per 100,000; by that of Pittsburgh, which is 88 per 100,000. These figures, however, do not show the entire mortality in the cities mentioned as a result of typhoid fever, for without doubt many of the deaths ascribed to "malarial fevers" were in fact due to typhoid infection. Thus in the city of Washington the deaths reported from typhoid and typho-malarial fever (average of 10 years) numbered 78.1 per 100,000 of the population, while 25.4 per 100,000 are recorded as due to malarial fever. In Baltimore the mortality as recorded from typhoid fever is 41.5, and from "typho-malarial and other malarial fevers" 18.3 per 100,000. In St. Louis the figures are: typhoid fever, 35.7, typho-malarial and other malarial fevers, 49 per 100,000; in New Orleans typhoid fever 26.1 typho-malarial and other malarial fevers, 107.2 per 100,000.

It will be seen that sanitary conditions at our military posts in time of peace, as judged by the typhoid death-rate, compare favorably with those in our large cities in various parts of the country. As a matter of fact great attention has been given to post sanitation for many years past, and through the per-

sistent efforts of officers of the medical department great improvements have been made, especially during the past ten years. The result is shown in a reduction of the typhoid mortality from 108 per 100,000 in the ten years ending in 1887, to 55 per 100,000 in the decade ending in 1897. Hygiene is made one of the principal subjects of examination for candidates desiring appointment in the medical corps of the army, and at subsequent examinations for promotion to the grade of captain and major, is given a most prominent place. It is also the most prominent subject in the course of instruction at the Army Medical School, where the student-officers spend five hours daily for a period of five months in practical laboratory work relating for the most part to the cause and prevention of infectious diseases. It should be remembered, however, that the Army Medical School was not established until 1892, and consequently but a small portion of the medical officers of the army have had the advantage of this course of instruction.

The comparatively small number of medical officers of the regular army available for duty in the large camps occupied by our volunteer troops at the outset of the war proved to be entirely inadequate to control the sanitary situation in these camps, and as a result of the conditions existing, the mortality from typhoid fever in our armies during the year ending April 30, 1899, has been more than twenty-two times the annual mortality in our regular army during the decade immediately preceding the war period. As compared with the first year of the Civil War, however, there is a decided improvement, the typhoid mortality for the first year of the Civil War having been 1971 per 100,000 of mean strength, and for the Spanish-American War, 1237 per 100,000. Moreover, as shown by the chart, the vigorous sanitary measures enforced enabled our troops to quickly free themselves from the ravages of this infectious disease, and while the line of typhoid mortality continued to ascend during the first year of the Civil War and subsequently, it rapidly fell after the middle of September last and for the last six months of the period under consideration has been remarkably low. Indeed, in the history of large armies the record has never heretofore been equaled.

In view of the great progress which has been made since the Civil War in our knowledge of the etiology and prevention of those infectious diseases, which have in the past been most fatal to armies, the writer had hoped that the mortality from preventable diseases might be greatly reduced from the outset, notwithstanding the difficulties inseparably connected with the hasty assembling of large bodies of undisciplined troops in our camps of instruction.

As we now know the cause of typhoid fever, the biologic characters of the typhoid bacillus, and the physical and chemic agents by which this bacillus may be destroyed, sanitarians have no difficulty in formulating rules relating to its prevention, which if strictly followed, would, to a great extent at least, protect our armies from its ravages.

In the writer's prize essay on "Disinfection and Personal Prophylaxis in Infectious Diseases," published by the American Public Health Association in 1885, the following directions will be found:

"In the sick-room we have disease germs at an advantage, for we know where to find them, as well as how to kill them. Having this knowledge, not to apply it would be criminal negligence, for our efforts to restrict the extension of infectious diseases must depend largely upon the proper use of disinfectants in the sick-room.

Disinfection of excreta, etc.—The dejections of patients suffering from an infectious disease should be disinfected before they are thrown into a water-closet or privy vault. This is especially important in cholera, typhoid fever, yellow fever and other diseases in which there is evidence that the infectious agent is capable of self-multiplication, in suitable pabulum, external to the human body. Vomited matters and the sputa, in these and other infectious diseases, should also be promptly disinfected. This is especially important in cholera, diphtheria, scarlet fever, whooping cough and tuberculosis. It seems advisable, also, to treat the urine of patients sick with an infectious disease with a disinfecting solution.

For the disinfection of excreta in the sick-room, a solution of chlorid of lime is to be recommended. This is an excellent and prompt deodorant, as well as a disinfectant. A quart of the standard solution (No. 2), recommended by the committee on disinfectants of the American Public Health Association, will suffice for an ordinary liquid discharge in cholera or typhoid fever; but for a copious discharge it will be prudent to use twice this quantity, and for solid fecal matter a stronger solution will be required. As chlorid of lime is quite cheap, it will be best to keep on the safe side, and to make the solution for the disinfection of excreta by dissolving eight ounces of chlorid of lime in a gallon of water. This solution should be placed in the vessel before it receives the discharge. The material to be disinfected should be well mixed with the disinfecting solution by agitating the vessel, and from thirty minutes to an hour should be allowed for the action of the disinfectant before the contents are thrown into a water-closet or privy vault."

In the manual for the medical department, which at the outset of the war was distributed for the information of all medical officers, the following directions will be found:

"91. *a*.—Disinfectants are issued, as are medicines, to be used by medical officers when actually required for some specific purpose. Chlorid of lime, carbolic acid and mercuric chlorid are issued by the medical department for use as disinfectants, properly so-called. A solution containing 4 per cent. of good chlorid of lime or 5 per cent. of carbolic acid is suitable for disinfecting the excreta of patients with cholera or typhoid fever, or the sputa of patients suffering from diphtheria, scarlet fever or tuberculosis. The floors, furniture, etc., in rooms occupied by patients suffering from an infectious disease, may be washed with a 2 per cent. solution of carbolic acid, or with mercuric chlorid of 1-1000. Soiled bed-linen, underclothing, etc., used by such patients, should be immersed in one of the above-mentioned solutions before it is sent to the laundry.

92. When accumulations of organic material undergoing decomposition can not be removed or buried they may be treated with an antiseptic solution or with freshly-burned quicklime. Quicklime is also a valuable disinfectant, and may be substituted for the more expensive chlorid of lime for disinfection of typhoid and cholera excreta, etc. For this purpose freshly-prepared milk of lime should be used, containing about one part, by weight, of hydrate of lime to eight of water.

93. During the prevalence of an epidemic, or when there is reason to believe that infectious material has been introduced from any source, latrines and cesspools may be treated with milk of lime in the proportion of 5 parts to 100 parts of the contents of vault, and the daily addition of 10 parts for 100 parts of daily increment of feces."

At the outset of the war with Spain sanitary circular No. 1 was issued. [See page 161.]

Early in August the attention of medical officers was again directed to the importance of camp sanitation and disinfection of the excreta of "patients with fever," by Circular No. 5.

"WAR DEPARTMENT: SURGEON-GENERAL'S OFFICE,
CIRCULAR NO. 5. WASHINGTON, Aug. 8, 1898.

The attention of medical officers is invited to Circular No. 1 from this office, dated Washington, April 25, 1898.

The extensive prevalence of typhoid fever in camps of instruction indicates that the sanitary recommendations made in this circular have not been carried out. If medical officers

have failed to make the proper recommendations as indicated, the responsibility rests with them. If the recommendations have been made and not acted upon by those having authority in the various camps, the responsibility is not with the medical department, but these recommendations should be repeated, and commanding officers urged to move their camps at frequent intervals and to maintain a strict sanitary police.

GEO. M. STERNBERG,
Surgeon-General, U. S. A."

IMPORTANT SANITARY RECOMMENDATIONS

The following letter was addressed to the adjutant-general of the Army on October 31.

"Adjutant-General of the Army, Sir:—I have the honor to make the following recommendations with reference to the protection of our troops in permanent camps in this country and in the islands at present occupied by our forces, from the infectious diseases which are liable to prevail where insanitary conditions exist:

1. No camp should be established unless there is an abundant supply of pure water for drinking, bathing and culinary purposes. Experience shows that reliance upon filtration, or upon sterilization by boiling, is very uncertain, owing to the difficulty of enforcing the use of the appliances provided for this purpose. Nevertheless, I recommend that portable filters of an approved model be supplied to troops in camp, for use when on the march or under any circumstances where it becomes necessary to use water which may possibly be contaminated by the germs of any one of the infectious diseases which experience has shown to be most dangerous to troops in the field—typhoid fever, cholera, dysentery, camp diarrhea, yellow fever. Company commanders should be made responsible for the proper use of these filters, and, as they require frequent cleaning and careful using in order to preserve their efficiency, they should be placed in the immediate care of a reliable and properly instructed non-commissioned officer, who should have a suitable detail to assist him in operating them for the filtration of all water used for drinking purposes.

2. Disposal of excreta. It has been demonstrated that the germs of typhoid fever, cholera, dysentery and camp diarrhea are present in the discharges of those suffering from these diseases and the propagation of these infectious camp diseases results, to a large extent, from failure to properly dispose of excreta. These diseases are frequently not recognized in the earlier stages or when the cases are mild in character, and the discharges of such persons thrown upon the ground or in sinks which are not properly disinfected almost inevitably lead to

a propagation of the disease and often to a general camp infection. This can only be guarded against by a complete system of sewers and water-closets connected with them, by some efficient method of removing excreta from the camp, or by its prompt and complete disinfection *in situ* if sinks are used. Experience shows that the latter method is difficult to carry out and requires the most constant and intelligent supervision. The first cost of a complete system of sewers for a camp which is to be occupied for several months would be small compared with the expense resulting from an epidemic of typhoid fever, yellow fever or cholera. It may be safely said that the expense resulting from the large number of cases of typhoid fever in our camps during the past summer has been greatly in excess of the cost of a system of sewers, where this would have been practicable, or of some other efficient method of disposing of excreta. As the best alternative where a camp is not to be occupied long enough to justify the establishment of a complete system of sewers, or where for any reason this is impracticable, I would suggest the following method of disposing of excreta: I would provide a sufficient number of cylindric galvanized iron receptacles, eighteen inches in diameter and eighteen inches deep, provided with a galvanized iron cover and having a trough around the outside of the vessel, three inches deep, for the purpose of containing a disinfecting fluid, in order that when the cover is in position this may serve as a valve preventing the entrance of flies or the escape of foul odors. A second cover of metal, having a proper aperture to serve as a privy seat, should be provided. When about to be used the closet cover would be removed from the iron receptacle, leaving the seat exposed. After use the cover should at once be replaced. These cylindric vessels could be partly filled with a solution of carbolic acid, or the contents could be treated with quicklime, dry earth or ashes. They should be removed at regular intervals and the contents emptied into a pit far removed from the camp, or disposed of by cremation. There should be a sufficient number of these vessels to put a clean one in position when those requiring removal are taken away to be emptied and cleaned. These vessels should be cleaned by the use of boiling water (or by incineration if practicable).

(Signed)

GEO. M. STERNBERG,
Surgeon-General U. S. A."

REASONS FOR PREVALENCE OF TYPHOID

We have now to inquire why, with our precise knowledge as to the etiology and means of prevention of typhoid fever, this infectious disease prevailed to such an extent in many of our camps during the first four or five months of the late war.

The reasons are apparent, and even in the light of our recent experience I am not sure that under similar conditions we could avoid similar results. Sanitarians generally are familiar with the difficulties attending their efforts to restrict the ravages of infectious diseases in towns and cities. They have to contend with the ignorance and reckless indifference of a large proportion of the population, with the ignorance and mistaken parsimony of legislative bodies, and to some extent with the negligence or perfunctory performance of duties assigned to them by agents of the health department, often appointed as a reward for political services rather than on account of their special fitness for the work. Perhaps it was too much to expect that typhoid fever should be excluded from our camps, unprovided with sewers and occupied by new levies of troops, having for the most part inexperienced officers both of the line and in the staff departments. The medical officers of regiments were appointed by the governors of States, and as a rule were competent professionally, but they were called upon to assume new responsibilities for which they had no special training. Unfortunately, hygiene and practical sanitation are subjects which receive little attention in our medical schools or from physicians and surgeons engaged in the practice of medicine. But even in those cases in which the regimental surgeon was fully aware of the importance of camp sanitation and urgent in his sanitary recommendations, he was unable to control the sanitary situation unless the regimental and company officers enforced the necessary measures for protecting the health of the command. And just here is the fundamental difficulty when we are dealing with new levies of troops. The officers and enlisted men of our volunteer regiments were as a rule intelligent, patriotic and brave, but they were not disciplined. Each man was in the habit of judging for himself and of acting in accordance with his individual judgment. Discipline consists essentially in an unquestioning obedience of orders from those having proper authority to give them. Trained officers can not at once establish discipline among untrained troops, and when both officers and enlisted men are without military experience it is evident that, with the best material, time will be required for the establishment of discipline. And in the absence of discipline it is impracticable to enforce proper sanitary regulations in camp. The Surgeon-General may formulate sanitary regulations, and the general commanding an army corps or a division may issue the necessary orders, but in the absence of discipline these orders will not be enforced. A reckless recruit will drink the water which has been condemned as unsafe, and at night will defile the ground in the vicinity of his tent rather than visit the company sink,

which, possibly is in a disgusting and unsanitary condition because of a failure to carry out the orders to cover the surface of excreta "with fresh earth, or quicklime, or ashes, three times a day."

The difficulty in controlling the sanitary situation, even when under the supervision of an experienced medical officer of the regular army, is illustrated by the following extract from a personal letter to the surgeon-general, referring to one of the camps occupied by volunteers who had returned from Cuba to be mustered out of service. Colonel Greenleaf says: "I have never had a more trying time than during the past two weeks in efforts to keep the camps reasonably clean. The approach of the muster-out period made officers and men equally indifferent to ordinary cleanliness, and without the cooperation of the quartermaster their camp would have been quickly untenable. We have had to hire civilians to clean the latrines, remove their contents and the garbage, clear the camp streets, and finally to stay on duty at the latrines and cover excrement as it was deposited! Orders, written and verbal, requiring the soldiers to do anything in the way of police were repeatedly issued but were totally disregarded, and the sinks and kitchens were soon infected with such swarms of flies that I felt sure there must be an outbreak of disease."

New levies of troops are especially subject to typhoid fever and other infectious camp diseases, not only because of a lack of discipline and consequent difficulty in the enforcement of necessary sanitary regulations, but also because the individual soldiers are very susceptible to infection, owing to their age, the abrupt change in their mode of life, the exposure and fatigue incident to camp life, and last but not least, their own imprudence as regards eating, drinking, exercise, etc. The trained soldier has not only learned the lesson of obedience to orders, but has learned how to take care of himself in the field. He will carry a canteen of boiled water or tea rather than trust to luck and drink any water at hand when he is thirsty. He has learned to control his appetite within moderate limits, and when issued rations for five days does not suffer from hunger on the fourth and fifth as a result of extravagant consumption or waste on the first and second days of the period for which he has been rationed. He takes advantage of opportunities for bathing, and washing his underclothing; and when his blankets or outer clothing are unavoidably wet he hastens to dry them in the sun or by a fire at the earliest opportunity.

The value of experience and special training is recognized by all departments of human activity, and the military calling furnishes no exception to the general rule. This applies to

the staff as well as to the line, and the medical staff is no exception. When, therefore, I say that the evils resulting from neglect of camp sanitation during the earlier months of the war were to some extent due to the inexperience of the regimental surgeons, I am not reflecting upon the professional qualifications of these gentlemen, but am simply stating a fact. I desire to say, at this point, that many of these regimental surgeons showed a decided aptitude for the service, and made themselves familiar with their various duties as medical officers within a comparatively short time. As a rule they have been assiduous in the care of the sick, and professionally they have been fully the equals of the average doctor in the sections of the country in which their regiments were raised. Indeed, in many instances they have been men who had attained distinction in their own State or even a national reputation.

There has been no failure on the part of the medical department of the volunteer army to accomplish all that could have been reasonably expected of it, but without doubt an adequate number of thoroughly trained medical officers could have done much at the outset of the war in the way of preventing the introduction and extension of typhoid fever in our camps, and in organizing and administering field hospitals, ambulance companies, etc.

Want of discipline and inexperience on the part of officers and enlisted men, together with the apparent emergency which caused them to be brought together in large camps in great haste and before proper preparation could be made for their reception and the supply of their many wants, were the fundamental, and to a large extent unavoidable, causes of the extension of typhoid fever in our camps. But the first step in the development of an epidemic of an infectious disease is the introduction of the specific germ to which it is due. Unfortunately, typhoid fever is endemic in nearly all parts of the United States, and when a thousand men are brought together from any section, there is a fair chance that one or more of them are already infected with this disease. Unless these cases are recognized at the very outset the camp site is liable to be contaminated by typhoid excreta, and the bacilli, through the agency of flies or in a desiccated condition carried by the wind, effect a lodgment on food being prepared in the company kitchens, and thus find their way to the alimentary tracts of susceptible individuals.

The attention of the profession has been largely attracted to the propagation of this disease through contamination of the water-supply, and to the distribution of the typhoid bacilli by the milkman, and there has perhaps been a tendency to overlook other modes of infection, which, in the absence of sewers

and under conditions such as existed in our camps during the first months of the war with Spain, were even more important. It is evident that one or two unrecognized cases might be sufficient to inaugurate an epidemic in a regimental camp, and as a matter of fact the disease has prevailed in nearly every camp in the country which has been occupied for a period of a month or more. In many cases it was brought to our large camps from the State camps where the regiments were mustered into service.

TYPHOID FEVER BOARD

And now, in order that the "sanitary lessons of the war" may not be lost sight of, and may be made available hereafter if we should again have occasion to assemble a large army on short notice, I consider it my duty to speak plainly with reference to one of the principal causes of the epidemic prevalence of typhoid fever in our camps. As a rule this disease was called by some other name by the medical officers, on duty with regiments, who first saw the cases. Usually it was assumed to be malarial fever, and was treated as such until the patient became so sick that it was found necessary to send him to the division field hospital or to a general hospital. This general statement is based upon the carefully made investigations of a board of medical officers appointed on my recommendation, made in the following letter:

"SURGEON-GENERAL'S OFFICE,
WASHINGTON, Aug. 17, 1898.

To the Adjutant-General of the Army:

Sir:—I have the honor to request that a board of sanitary experts may be constituted for the purpose of visiting the various camps within the limits of the United States, and making a searching investigation with reference to the cause of the extensive prevalence of typhoid fever in many of these camps. The board to receive detailed instructions from the surgeon-general of the army, and to make a full report as soon as practicable after the completion of their investigation.

I would also recommend that this board be directed, while pursuing their investigations, to call the attention of the proper authorities to any insanitary conditions existing at the camps visited by them, and to make recommendations with a view to their prompt correction. I recommend the detail of the following medical officers for this duty: Major WALTER REED, Surgeon U. S. A., Major VICTOR C. VAUGHAN, Division Surgeon U. S. V., Major EDWARD O. SHAKESPEARE, Brigade Surgeon U. S. V.

(Signed)

GEO. M. STERNBERG,
Surgeon-General U. S. A."

In a paper read by Major Victor C. Vaughan, at the meeting of the Association of American Physicians held in Washington, D. C., early in May, which paper may be regarded as a preliminary report of the board, the following statements are made:

"We had not finished our first day's work at Camp Alger before we saw that one factor in the problem must be thoroughly dealt with before we could hope to reach a satisfactory solution. Fortunately, we promptly took steps to acquaint ourselves with this factor. It can not be denied that scientific medicine would have gained much had this factor been provided for at an earlier date. I refer to the question of scientific diagnosis of typhoid fever. In the division hospital at Camp Alger we found most of the febrile cases diagnosed as malarial. We believe that they were typhoid fever, but the surgeon in charge had diagnosed them malaria. We requested that competent men properly equipped for making blood examinations for the malarial plasmodium and the Widal test, should be sent to each of the larger camps. The surgeon-general acted promptly on this suggestion. Drs. Gray and Carroll, of the Army Medical Museum, went to Camp Alger for this purpose. Subsequently Dr. Carroll continued this work at Jacksonville. Dr. Dock, of the University of Michigan, made investigations at Chickamauga, Knoxville and Meade. Acting Asst.-Surg. Craig also spent several weeks in making blood examinations at Sternberg Hospital, Chickamauga Park. Dr. Curry, Acting Asst.-Surg. at Fort Myer, has made many hundreds of blood examinations on sick soldiers sent to Camp Alger, Jacksonville and other camps. As a result of the work done by these men we are able to state that malaria was a very rare disease among those troops who remained in the United States.

To summarize concerning the so-called protracted malarias reported by the regimental surgeons, I will say that, in my opinion, practically all of these were typhoid fever, and the following are my reasons for this opinion:

1. The uneven distribution of the so-called malaria among regiments encamped side by side gives cause to suspect that these cases were not malarial.
2. Some of the surgeons who failed to record their cases as typhoidal, state in their comments that typhoid fever prevailed in the regiments.
3. The results of several hundred blood examinations showed that malaria was a very rare disease among the troops that remained in the United States.

4. Malaria as it exists in this country is easily controlled by mild doses of quinin. All the so-called protracted malarias in our camp were treated with large doses of quinin and were not improved thereby. Consequently, we must conclude that the diagnosis given these cases was erroneous.

5. The mortality of the so-called protracted malarias corresponds with the mortality of typhoid fever and furnishes most positive proof that these cases were not malarial.

When we began to study the regimental sick reports we found that in order to obtain satisfactory information, we must endeavor to ascertain how many cases of typhoid fever there were in each regiment, and it soon became evident that the regimental sick reports did not give this information. Of two regiments in the same brigade one had more than 200 cases of typhoid fever, as shown by the regimental reports; while the other regiment on like evidence had only two cases, but the records of the second regiment show more than 200 cases of protracted malaria, and these furnished a mortality as high as that of the typhoid fever in the first regiment. For the reasons already given, we have included all the protracted malarias among our list of typhoids. It may be asked how long we have considered it necessary for a so-called malaria to run in order to make it a probable typhoid. In answer to this I will state that we have regarded all so-called malarias of ten days or more in duration as possible cases of typhoid fever. We think that the great rarity of true malaria and the readiness with which these rare cases have yielded to quinin, and the fact that quinin was so generally administered justifies us in this conclusion. Practically, however, the number of doubtful cases is exceedingly small.

Typhoid fever was not only diagnosed malaria, but it was covered up by many other names. In one regiment the death-rate from indigestion amounted to 15 per cent. of the completed cases. In another regiment at Chickamauga dengue was a frequent diagnosis of many cases which undoubtedly were typhoid fever. . . ."

MISTAKEN DIAGNOSIS

The mode of origin and spread of typhoid fever in our camps is illustrated by a recent epidemic in the camp of the 8th Cavalry at Puerto Principe, Cuba. Major Walter Reed, Surgeon U. S. A., was sent at my request to make a special investigation with reference to the origin of this epidemic. The following quotation from his report shows that, as usual, this epidemic had its origin in a failure to promptly recognize the disease, and a consequent failure to disinfect excreta and to move the troops from the infected camp site:

"The total number of cases of typhoid fever that had occurred to date was reported by the regimental medical officers as 103, with 24 deaths. Taking the average mortality of this disease in military camps, I am of the opinion that not less than 250 cases of typhoid fever occurred in the 8th Cavalry during the epidemic.

To sum up briefly the occurrence of typhoid fever in the 8th Cavalry, I find that the disease was imported by this regiment into its Cuban camp, but was mistaken by the various medical officers on duty with the regiment for malarial remittent fever, until the epidemic had reached serious proportions; that it was clearly not due to water infection, but was transferred from the infected stools of patients to the food by means of flies, the conditions being especially favorable for this manner of dissemination by reason of the close proximity of the picket line to mess-tents and latrines. I also find that the lax methods of disinfection of stools and clothing of patients in hospital were additional sources of infection.

I find here a repetition of the same story of mistaken diagnosis with regard to the character of camp fevers that occurred in every military camp in the United States last summer, and the same absence of any evidence pointing to the contamination of the drinking water."

DIFFERENTIAL DIAGNOSIS

This failure to recognize typhoid fever during its earlier stages is an error of diagnosis which was made on a very extensive scale during the Civil War, has been made on an equally extensive scale by surgeons of the British army on duty with troops in India, and is still being made by a majority of the practitioners of medicine in certain parts of our own country.

The fact that enteric fever has an intermittent or remittent character has been pointed out by many authors and was referred to in the writer's work on "Malaria and Malarial Diseases," published in 1884, as follows:

"Probably one of the most common mistakes in diagnosis, made in all parts of the world where malarial and enteric fevers are endemic, is that of calling an attack of fever, belonging to the last named category, remittent. This arises from the difficulties attending a differential diagnosis at the outset, and from the fact that having once made a diagnosis of remittent, the physician, even if convinced later that a mistake has been made, does not always feel willing to confess it. The case therefore appears in the mortality returns if it prove fatal, or in the statistic reports of disease, if made by an army or navy surgeon, as at first diagnosed. Quite as frequently, perhaps,

the physician remains convinced that his first diagnosis was correct, inasmuch as the fever was decidedly remittent in type during the first week, and is puzzled to know why he did not succeed in arresting the progress of the disease by the free administration of quinin. By referring to the literature of the subject he will find ample support for the view that remittent fevers are likely to assume a continued form, and that patients suffering from malarial fevers of a remittent or continued type frequently fall into a typhoid condition. It is, therefore, not surprising that mistakes are frequently made, especially when we remember that during the first week typhoid has a decidedly remittent character, quite independently of any malarial complication, and that the periodic fluctuations of the pyretic movement are still more pronounced when it occurs in a malarial subject, i.e., one who has suffered frequent attacks of periodic fever. Moreover, there are undoubtedly cases of enteric fever of so mild a form that all of the characters commonly relied upon for making a diagnosis are wanting, and these cases of typhoid poisoning may be complicated by the most decided evidences of malarial poisoning when the case occurs in a malarious region, or in an individual who has been recently exposed in such a region."

This failure to recognize typhoid fever, especially in its earlier stages and in its milder manifestations, is not peculiar to American physicians, but has occurred in all parts of the world where the two diseases prevail in the same area. In India for many years the British medical officers denied that typhoid fever existed as an endemic disease.

The differential diagnosis of typhoid and malarial fevers can be made at an earlier date and with much greater certainty by a microscopic examination of the blood and the application of the Widal test than was practicable before the discovery of the malarial parasite and of the specific agglutinating action of blood serum from a typhoid case upon a culture of the bacillus. But these scientific studies are so recent that the profession generally still depends upon specially trained experts for their application to the diagnosis of doubtful cases. It is to be hoped, however, that the time is not far distant when every qualified practitioner of medicine will be prepared to apply these invaluable means of diagnosis.

PRINCIPAL SANITARY LESSONS

Finally, the principal lessons to be derived from our recent experience may be stated as follows:

A trained medical corps hardly adequate for an army of 25,000 men can not control the sanitary situation when this army is quickly expanded to 250,000. Physicians and surgeons

from civil life, however well qualified professionally, as a rule, are not prepared to assume the responsibilities of medical officers charged with administrative duties and the sanitary supervision of camps. The proper performance of such duties can not be expected from a physician without military training or experience, no matter how distinguished a position he may have held in civil life.

Courage and patriotism on the part of line officers and enlisted men can not take the place of knowledge and experience; new levies of troops are, as a rule, ignorant of the first principles of camp sanitation, and reckless as to the consequences of their neglect of prescribed sanitary regulations. Therefore, training and discipline are essential factors in the preservation of the health of soldiers in garrison or in the field.

The value of the aphorism, "in time of peace prepare for war," has received additional support. This preparation should include a corps of trained medical officers larger than is absolutely necessary for the army on a peace basis, and systematic instruction in military medicine and hygiene for the medical officers of the national guard as well as for those of the regular army; also instruction of line officers in the elements of hygiene and especially in camp sanitation. It should also include the establishment of camping-grounds in various parts of the country, having an ample supply of pure water, a proper system of sewers, etc. If our volunteers could have been assembled in such camps during the late war a saving in lives and money would have resulted which would without doubt have demonstrated the economy of such preparation for war in time of peace."

ANSWERS TO CRITICISMS

In reply to certain broad criticisms of the Medical Department during the war, General Sternberg addressed the following communication to the Adjutant-General of the Army, December 16, 1901:

To the Adjutant-General of the Army.

Sir:—Referring to the remarks of Dr. Charles A. L. Reed, at a banquet given him by the medical profession of Northern Ohio, I have the honor to report as follows:

It is evident that in speaking of the losses from a preventable disease in one of our camps during the Spanish-American War, Dr. Reed refers to Camp Thomas, Chickamauga Park, Ga. It is true that the troops in that camp suffered severe losses from typhoid fever, and it is also true that the medical profession generally regard typhoid fever as a preventable disease. We have succeeded in preventing any considerable prev-

alence of typhoid fever at our permanent military posts during the past twenty years by constant attention to sanitation. But when considerable numbers of raw troops, with line officers and medical officers who for the most part were without previous experience in the sanitary supervision of troops, were brought into camps not previously prepared for their reception the result was disastrous, and in nearly every camp throughout the country typhoid fever prevailed as an epidemic. The causes for this are set forth in my paper on "Sanitary Lessons of the War," read before the American Medical Association at Columbus, Ohio, in 1899, a copy of which I enclose herewith. It is evident that no one man can properly be held responsible for the conditions which existed at Camp Thomas, although the Commanding General of a camp, or army in the field, is supposed to be responsible for everything pertaining to the well-being of the troops under his command. Under existing regulations officers of the Medical Department are simply responsible that proper sanitary recommendations are made to officers of the line having authority to carry them out.

Major William O. Owen, Surgeon, U. S. Army, some time since read a paper before a medical society in Cincinnati in which he advocated the view that medical officers should be given the authority for carrying out necessary measures. In that case they would be responsible for any failure to carry out necessary sanitary measures for the protection of troops with which they were serving. But this would often involve the moving of troops from one camp site to another, and measures which evidently could not properly be executed except by authority of the Commanding Officer. Dr. Reed, and civilians generally, can hardly be expected to appreciate the military reasons which make it impracticable to place the control of sanitary matters entirely in the hands of the Medical Department. A medical officer might consider it necessary to order the construction of sewers or the sinking of wells at a camp which was shortly to be abandoned, the fact being known to the commanding officer but for military reasons not made public.

Dr. Reed's statement that "an officer in the service who today agitates this unsavory subject is banished to the Philippines" is based upon the fact that Major Owen, who read the paper above referred to, has been ordered to the Philippines and some of his friends have inferred that his being so ordered was a result of his reading the paper, a copy of which is enclosed. This is a mistake. I asked for Major Owen's orders before having seen or heard anything of his paper, because he had been on duty in the United States for more than two years and his services are required in the Philippines.

As to the statement that "the Surgeon-General cannot fill the sixty or more vacancies now existing in his Corps, and that self-respecting men are not offering themselves," I would say that there have been more than four hundred applications for admission to the Medical Corps during the past year, and eighty physicians, many of whom had had previous service and were entirely familiar with existing conditions in the Army, have passed our army medical examining boards and been commissioned as assistant surgeons in the Army. It is a fact, however, that the legislation enacted last winter gave us a disproportionate number of medical officers in the lowest grade and that without additional legislation in the future assistant surgeons who enter the Army hereafter to fill existing vacancies (60) will be at a disadvantage as regards promotion. This will no doubt prevent some desirable men from civil life, and a certain number of contract surgeons and Volunteer medical officers, from applying for commissions in the Regular Army.

MILITARY HYGIENE AT WEST POINT

Inasmuch as commanding officers of troops are, and must be, directly responsible for the carrying out of all necessary sanitary improvements and regulations in garrisons and camps, I respectfully invite attention to the importance of instructing line officers in all that relates to military hygiene. In this connection attention is also invited to the recommendation of the Board of Visitors to the U. S. Military Academy for the year 1901, which is as follows:

"The question of the establishment of a course on military hygiene has received the careful attention of the committee. They beg to submit to the board for indorsement and approval the following propositions, some of which are extracted from a previous report upon the same subject made by the chairman:

"1. The establishment of such a course has been repeatedly recommended by Boards of Visitors and Surgeon-Generals, and has been approved on more than one occasion by the Secretary of War.

"2. As long ago as 1894 the Board of Visitors argued in support of the establishment of such a chair, to the effect that the mere rudiments of hygiene in relation only to personal health cannot be acquired by the cadets in so short a course as was then, and is now, given at the Academy (ten hours altogether of lectures and recitations); and when, in addition, the important questions of the proper or improper feeding, clothing, housing, and physical training of the soldiers in peace and during the exigencies of war; the prevalence and prevention of disease, which makes far greater inroads upon the

effective strength of an army than do the shot and shell of the enemy, and the complicated problems of the effective yet practicable sanitation of barracks and camps are considered thorough instruction in this department is seen to be not only desirable but urgent, and in fact, necessary.

"3. The American Medical Association, representing the profession of the entire country, has recently (June 7, 1899) unanimously recommended 'that a professor of military hygiene be appointed at West Point to instruct the cadets in the principles of sanitation,' and resolved that a Committee be appointed to wait upon and present this and other resolutions to the President of the United States for his favorable consideration."

Very respectfully,

GEO. M. STERNBERG,

Surgeon-General, U. S. Army.

As a reply to an article by Col. Theodore Roosevelt, then Governor of New York, unfavorably contrasting the organization of the War Department with the Navy Department, General Sternberg submitted an article to *The Century Magazine* in 1899. The editor of *The Century* declined to publish it in full for want of space, and, in a letter dated Dec. 5, 1899, the "associate editor" said, "We ought to add that the first of February is the first date on which the article could appear and we might not find two pages then." It was therefore withdrawn, and General Sternberg published privately the following defense of the War Department.

In the *Century Magazine* for November, 1899, is an article by Governor Roosevelt contrasting the condition of the Army and Navy at the outbreak of the war with Spain, in which very unfavorable inferences are drawn as regards the efficiency of the Chiefs of Bureaus in the War Department.

We are all proud of the achievements of our navy and are ready to do full honor to the naval heroes of the war and to the bureau officers in the Navy Department who have directed the equipment and movements of our ships of war. But it may be questioned whether such a comparison as Governor Roosevelt has made is in good taste, and I think it can easily be shown that it is, to a certain extent at least, unjust. That the navy was better prepared for a foreign war than the army is undoubtedly true. For years past large appropriations have been made for the purpose of building up a "new navy," and we have now a fleet of battleships and cruisers which commands the admiration of the world. On the other hand, all

efforts to obtain legislation for an increase in the army, or for its reorganization in accordance with the views of our leading military experts, have proved futile and our army when war was declared had practically the same strength and organization as it has had for many years. Nevertheless, I make bold to say, our little army of 25,000 men in its soldierly qualities and fighting capacity was unexcelled.

It is not my present intention to discuss the organization of our army, or to contrast its achievements with those of the navy. There is an old proverb with reference to comparisons. But I beg leave to call the attention of Governor Roosevelt and others who are inclined to make such comparisons, to the following facts:

The army was expanded within two months from 25,000 to more than 250,000 men. The enlisted personnel of the navy did not at any time during the war exceed 24,500 men. The ships of the navy afford to our sailors comfortable quarters and ample transportation for supplies of all kinds, and when ordered to sea they are usually outfitted at a navy yard where supplies of all kinds are stored. On the other hand, the supplies for the army must be shipped from the various supply depots or purchasing points to the numerous and often distant camps where the troops are assembled. The problems, therefore, connected with the transportation of troops and supplies, which are recognized by all military authorities as being among the most important and difficult of all these connected with the organization and mobilization of a large army, are peculiar to the military service.

Again, the difficulties connected with the sanitation of camps, especially when new levies of undisciplined troops are hastily assembled, are peculiar to the military service. Sailors on ship-board are removed from many influences which contribute to the sick-rate of the army. They have the ocean for a sewer and are not exposed to the insanitary conditions resulting from the aggregation of soldiers in large camps or to the hardships connected with an active campaign in a tropical country.

Governor Roosevelt refers to the bureaus of the War Department in the following language:

"The bureaus in Washington were absolutely enmeshed in red tape, and were held for the most part by elderly men, of fine records in the past, who were no longer fit to break through routine and to show the extraordinary energy, business capacity, initiative, and willingness to accept responsibility which were needed."

The bureau officers of the War Department were subjected to much unjust criticism during the war which they were obliged to endure in silence, both because their time was fully

occupied by their official duties and because it is considered undignified for a person in high official position to reply to the attacks of newspaper correspondents. But when the governor of the State of New York makes such an assertion as that above quoted in a periodical having the standing of the *Century Magazine*, it appears to me that as a matter of justice and of historical record some one having a knowledge of the facts should reply.

As to the bureaux in Washington being "absolutely enmeshed in red tape," I believe that an impartial investigation will show that there is no more red tape in the army than in the navy. The methods of business ("red tape") pursued in the various bureaux of the War Department are based upon laws enacted by Congress, and regulations, based upon past military experience, which were carefully revised as recently as 1895 by a board of officers appointed by the Hon. Daniel S. Lamont, then Secretary of War. Bureau chiefs are subject to these laws and regulations, and it is evident that without a well-established system the administration of the various departments would be in a chaotic condition. That there is no room for improvement it would be foolish to contend; but the present system, so far as army regulations are concerned, is the result of many years of experience and of constant efforts for improvement by a series of more or less efficient bureau chiefs and Secretaries of War.

During the war with Spain and subsequently, urgent business with the various bureaux of the War Department has been largely conducted by telegraph, and that kind of "red tape" which leads to delay in the transaction of important business has to a considerable extent been done away with. The bureau officers have acted in harmony and those who are familiar with the facts know that each one has devoted himself with untiring energy to the dispatch of public business, and that so far as was compatible with existing laws and regulations they have endeavored to do away with "red tape."

Governor Roosevelt informs the readers of the *Century Magazine* that the bureaux in Washington "were held for the most part by elderly men, of fine records in the past, who were no longer fit to break through routine," etc. The bureau officers of the navy, on the other hand, are commended and the inference is that they were much younger and more active men. Let us, for a moment, consider the facts. The Chief of the Bureau of Navigation in the navy, as regards his duties, may best be compared with the Adjutant-General of the army, although the work of the Adjutant-General's Office is many times greater, especially when large numbers of volunteer troops are called into service. Admiral Crownshield was 55 years old when war with Spain was declared. Adjutant-

General Corbin was also 55 years old, but looks five years younger. He is a man of powerful physique, of untiring energy and of great executive ability. As assistants in his office he has had General Schwan, Lieut. Col. Carter, Major Heistand, Major Johnston and Major Simpson. All men of marked ability, all having had ample experience as line officers, and all, with the exception of General Schwan, less than 50 years of age. The Adjutant-General himself was a line officer for eighteen years. Probably few of the bureau officers of the navy have been to sea more years than this.

The duties devolving upon the Commissary-General and Quartermaster-General of the Army, in the Navy pertain to the office of the Paymaster-General. Paymaster-General Stewart of the navy was past sixty years of age when war was declared. The Quartermaster-General of the Army was a vigorous man of 58, who has stood the enormous strain of the war period without breaking down in health or relaxing his strenuous efforts to meet the enormous demands upon his department for transportation, clothing, camp and garrison equipage, etc., etc.

General Egan, Commissary-General, was 57 years old when war was declared. He certainly cannot justly be accused of want of physical vigor or mental activity. The Inspector-General of the Army was but 56 years old when war was declared. The Surgeon-General was 59 years old, nearly two years older than the Surgeon-General of the Navy. The Engineer in Chief in charge of the Bureau of Steam Engineering of the Navy, was 57 years old; the Chief of the Bureau of Equipment 54; the Chief of the Bureau of Ordnance 56. General Wilson, Chief of Engineers, is certainly one of the most vigorous and able men in the War Department; he was 60 years old when war was declared. General Greely, Chief Signal Officer, was only 54.

The argument of Governor Roosevelt in favor of detailing line officers of the army for duty in charge of the bureaus of the War Department receives no support from the practice in the Navy so far as the Quartermaster, Commissary and Medical Departments are concerned. The Paymaster-General, Chief of the Bureau of Steam Engineering and Surgeon-General of the Navy are not detailed officers of the line and evidently could not be without prejudice to the interests of the service. In the army the officers of the Adjutant-General's and of the Inspector-General's Department have always been selected from the line of the army, and as a rule the Commissaries and Quartermasters have also been line officers of experience. Under present laws no others are appointed. In the scientific corps of the army—Engineer and Ordnance—the special knowledge required is of such a nature that it may

be doubted whether it would be in the interest of the service to detail line officers to administer the affairs of these bureaus of the War Department. Certainly it would be a difficult task to name any officers of the line as competent to fill these places as are the present distinguished incumbents, General Wilson and General Buffington.

Finally, I would say that, with three exceptions—General Egan, Commissary-General, General Flagler, Chief of Ordnance, who died in March, 1899, and the Paymaster-General, who was retired for age in January, 1899, the bureau officers of the War Department are the same as those upon whom was thrown the responsibility of providing for an army of 260,000 men in the spring of 1898. Time is an essential element in all great undertakings, and it takes time to organize and equip an army as well as to build a battleship. No amount of money or energy would enable the bureau officers of the Navy to build a battleship in three months, and it is unreasonable to hold the bureau officers of the War Department responsible for the unavoidable difficulties and failures connected with the organization and equipment of a large army after war was declared. That we were not better prepared was not the fault of the War Department, for supplies could not be purchased without money and our estimates have for years been cut down by Congress. What can be accomplished by the War Department when the necessary money is appropriated and a reasonable time allowed for the accomplishment of the objects in view is shown by the organization, equipment and transportation of the troops now in the Philippines and on their way there; by the magnificent fleet of transports and hospital ships now owned by the Government; by the model hospitals which have been established in this country, in the Philippines and in Cuba, and, in short, by the magnificent results attained during the war with Spain and since, notwithstanding the "unpreparedness" to which Governor Roosevelt refers, and which cannot be denied, but for which it is rank injustice to hold the chiefs of bureaus of the War Department responsible.

CHAPTER FIFTEEN

SCIENTIFIC ACHIEVEMENTS DURING THE SPANISH-AMERICAN WAR

General Sternberg notwithstanding the many hours of anxiety and the responsibilities connected with the medical administration of the war never lost interest in scientific research, to the development of which he had devoted the best years of his life. His continued interest is attested by the appointment of various boards for investigation into the etiology and prevention of important diseases. Reference has already been made to the appointment of a board of sanitary experts for making a searching study of the causes of the extensive prevalence of typhoid fever in the military camps. Another board for the same purpose was appointed in the Philippine Islands.

BOARD FOR STUDY OF TROPICAL DISEASES

But General Sternberg did not limit his interest to typhoid fever, for it is noted in the report of the Surgeon-General for 1900 "that on his recommendation a board of medical officers consisting of Dr. Jere B. Clayton, Dr. Richard P. Strong, Assistant Surgeons, U. S. Army, and Acting Assistant Surgeon Joseph J. Curry, was appointed to meet at one of the general hospitals in or near Manila, P. I. for the purpose of studying tropical diseases as they occur in those Islands. Special attention should be given to tropical dysentery, to the malarial fevers prevailing in the Philippines, to beriberi, to intestinal parasites, and in general to all tropical diseases, the etiology of which has not been completely worked out."

Excellent work was done by the members of this board and their associates in the laboratories of the large hospitals, which may be briefly summarized.

ISOLATION OF BACILLUS DYSENTERIAE

Lieut. Richard P. Strong made a careful study of dysentery cases in the laboratory of the First Reserve Hospital, Manila, in which work he was assisted by hospital steward, W. E. Mus-

grave, M.D., pathologist of the hospital. A report of the results of these investigations was issued June 17, 1900. During a period of ten months prior to this date, 9,063 cases were treated in the hospital and 1,328 (14.64 per cent.) of these were cases of dysentery. Of the latter patients, 581 were returned to duty, 125 ended fatally in the hospital, 283 were transferred to other hospitals in the Philippines, and 336 were sent to the United States for possible benefit from the sea voyage and change of climate. The studies included 111 necropsies on dysenteric cases, twenty-one of which were classified on anatomic grounds as acute specific dysentery. A bacillus was isolated in seventeen of these twenty-one cases, and in two of eleven subacute cases. In one of the former and two of the latter, the bacillus was not looked for; in twenty-six of the amebic cases the bacillus was not found and in the remaining fifty-three it was not sought, while in sixty-eight of seventy-nine amebic cases, motile *Amoebae dysenteriae* were found. The bacillus isolated by Drs. Strong and Musgrave is similar to that discovered by Shiga in Kitasato's laboratory in 1898, and is today recognized as the specific cause of bacillary dysentery.

Splendid work was also done by Dr. Charles F. Craig on subacute and chronic dysentery at the U. S. General Hospital at the Presidio of San Francisco, where he gave close attention to cases coming from Manila. He isolated a bacillus identical with that found by Dr. Flexner in Manila, previously described by Shiga, which was pathogenic to small animals.

PLAGUE IN MANILA

In December, 1899, bubonic plague appeared in Manila. The first two cases occurred in the same house and were reported as typhoid fever. The disease prevailed for seven months, during which 225 cases were reported with fifty-eight recoveries, while from forty to eighty Chinese died from unknown cause without medical attendance; some of these presumably were victims of plague. Lieut. W. J. Calvert, Assistant Surgeon U. S. Army, then on duty with the board of health in Manila, was sent on a special visit to Japan and China, for the purpose of studying the measures in use in dealing with epidemic plague.

In connection with this subject, General Sternberg says:

Fortunately this outbreak gave opportunity for competent bacteriologists to make scientific investigation in relation to the specific cause of this scourge of the human race and to the demonstration that it is due to a minute bacillus. The discovery was first made by the Japanese bacteriologist, Kitasato, who had received his training in the laboratory of the famous Prof. Robert Koch of Berlin. This discovery was made in the month of June, 1894, in one of the hospitals established by the English officials in Hongkong. About the same time, the discovery was made independently by the French bacteriologist, Yersin. From this time, the study of the plague has been established upon a scientific basis, and several material additions have been made to our knowledge with reference to the prevention and treatment of the disease. We have learned that certain of the lower animals, including rats and mice, are very susceptible to infection, and they play an important part in the propagation of the disease; also that the germs are found not only in the blood and in the pus from suppurating buboes, but also in the discharge from the bowels of infected individuals. This being the case, it can readily be seen how important a strict sanitary police is in arresting the spread of an epidemic. As in other filth diseases in which the germ is present in the excreta of the sick, insects, and especially fleas and house flies probably play an important part in the spread of the disease."¹

1. The good work of medical officers initiated by General Sternberg did not cease, as Lieut.-Col. C. C. McCulloch (Scientific Monthly, May, 1917, p. 424) informs us. Captain Craig in the Philippines "demonstrated that intracorporeal conjugation in the parasites of malarial fever is the cause of latency and relapses of the disease, and that these are malaria carriers, that is persons who carry the malarial parasites about with them without being affected by the disease. In 1906, Craig discovered a new parasite associated with dysenteric infections, the *Paramoeba* (now called *Craigia*) *hominis*. With Major Percy M. Ashburn, he discovered another parasite, *Microfilaria philippinensis*, in 1906, and demonstrated that the cause of dengue or break-bone fever is a filterable virus transmitted by the mosquito *Culex fatigans* (1907). In the Philippines also, Capt. Edward B. Vedder made important investigations of beriberi, a tropical form of neuritis which has been attributed to an exclusive diet of highly milled or polished rice. It was found that the disease is what is now termed a "deficiency disease," that is, one caused by a diet deficient in certain substances necessary to the physiological economy of the body."

DISCOVERY OF HOOKWORM IN WESTERN HEMISPHERE

The Spanish-American War demonstrated the existence of the so-called hookworm disease in the Western hemisphere. The disease had been recognized as a true soil disease for a number of years, certainly since 1879 when Perroncito demonstrated that the general anemia and debility among the miners in the construction of the St. Gothard tunnel was caused by this intestinal parasite. The worm is about one-half or two-thirds inch in length and of the thickness of a pin and produces its evil effects by attaching itself to the upper portion of the intestine and by generating toxins.

It was, however, through the labors of Dr. Bailey K. Ashford, a graduate of the Army Medical School, that the prevalence of the disease on this continent was brought to attention. He demonstrated, in 1899, that the pale, dropsical and debilitated condition of the peasant population of Porto Rico, was not the result of malaria, starvation and other suspected causes, but was due to infestation by the hookworm. He isolated the parasite from the dejections of the natives, and showed conclusively that the disease was amenable to preventive and curative therapy. It was pointed out that in the rural districts of Porto Rico, where the disease is most common, there are practically no privies and the soil is promiscuously polluted with fecal matter, as many as fifty larvae having been known to cling to a bit of soil the size of a pea. The larvae penetrated the sound skin of the barefooted farm laborers, causing "ground itch" and the disease was also conveyed by infected food and water. The economic importance of hookworm disease is apparent when it is considered that about 800,000 (90 per cent.) of the laborers in the coffee and sugar plantations of Porto Rico were infected. In 1902, Prof. Stiles of the Public Health Service demonstrated that hookworm disease was prevalent in our southern states, and that it was responsible for great economic losses, just as Dr. Ashford had shown it to be the industrial curse of Porto Rico. Indeed much of the so-called chronic malaria, ignorance, poverty and general inefficiency in the world's tropical and subtropical belts could be attributed to hookworm infection. The number of victims in the United States has been estimated at 2,000,000 and the economic loss at \$100,000,000 per year. Dr. Ashford's cam-

paign against hookworm disease in Porto Rico resulted in cure in the majority of cases, led the way to similar efforts elsewhere, and inspired the program of the Rockefeller Foundation for world wide eradication of the disease.

YELLOW FEVER COMMISSION

The most important and most brilliant piece of research work during this period was accomplished by a board appointed on the recommendation of General Sternberg in May, 1900, to meet at Camp Columbia, Quemados, Cuba, for the purpose of pursuing scientific investigations of the infectious diseases prevailing in the Island of Cuba, with special reference to yellow fever.

The board was composed of Surgeon Walter Reed, Contract Surgeons James Carroll, Aristides Agramonte, and Jesse W. Lazear, U. S. Army. By a series of painstaking experiments it was demonstrated that the virus of yellow fever is transmitted by a certain species of mosquito (*Stegomyia fasciata*), and the theory that the disease could be conveyed in fomites, or that it was contagious in the ordinary acceptance of the term was disproved conclusively. The practical application of this discovery resulted in the eradication of the scourge from Havana by Dr. William C. Gorgas (lately Surgeon-General, U. S. Army), and in the sanitary achievements contributing to the successful building of the Panama Canal.

I may be pardoned for calling attention to the fact, that when this commission was appointed, the alleged discovery by Dr. Giuseppe Sanarelli of a specific *Bacillus icteroides* had been confirmed by a commission of the Public Health and Marine Hospital Service. Had General Sternberg accepted this as conclusive, we might still be periodically visited by epidemics of yellow fever and the Panama Canal would probably be far from completion.

It is not my purpose to detract in the slightest degree from the brilliant work of Dr. Walter Reed and his brave associates of the Yellow Fever Commission, but as a loyal wife and one familiar with the research work of my lamented husband on the etiology of yellow fever, which culminated in the findings of the Reed board, I may be privileged to present certain illuminating facts. This is all the more important since the

medical profession was not generally informed of General Sternberg's preliminary work, while credit for the appointment of the commission was even given to others, as is shown by a letter from Dr. William H. Welch of Johns Hopkins Medical School, April 16, 1910, in which he says:

"As all that relates to the history and work of this commission is highly important, permit me to say that the credit for the creation of this commission belongs solely to General Sternberg, who had previously so completely exhausted the purely bacteriologic study of yellow fever that it was possible for the commission to follow the new direction which proved so fruitful in results."

Among the official papers left by my husband, I find the following:

Surgeon-General's Office,
Washington, May 23rd, 1900.

To the Adjutant-General of the Army:

I have the honor to recommend that Major Walter Reed, Surgeon, U. S. Army, and Contract Surgeon James Carroll, U. S. Army, be ordered to proceed from this city to Camp Columbia, Cuba, reporting their arrival and instructions to the commanding officer of the post.

I also recommend the organization of a medical board with headquarters at Camp Columbia for the purpose of pursuing scientific investigations with reference to the infectious diseases prevalent on the Island of Cuba and especially of yellow fever.

The board is to be constituted as follows:

Major Walter Reed, Surgeon U. S. Army; Contract Surgeon James Carroll, U. S. Army, and Contract Surgeons Aristides Agramonte and Jesse W. Lazear, U. S. Army. . . .

The board should act under general instructions which will be communicated to Major Reed by the Surgeon-General of the Army.

Very respectfully,

GEO. M. STERNBERG,
Surgeon-General, U. S. Army.

Major Walter Reed, at that time professor of bacteriology at the Army Medical School, was splendidly equipped for the duty and perfectly familiar with General Sternberg's preliminary work. They had been close friends for years and enjoyed each other's confidence, and a better selection could

not have been made in the personnel of the board. Dr. Aristides Agramonte, the only surviving member of the board, has reviewed the various steps which culminated so successfully. He writes regarding the preliminary instructions:

On the afternoon of June 25, 1900, the four officers met for the first time in their new capacity on the veranda of the officers' quarters at Columbia Barracks Hospital. We were fully appreciative of the trust, and aware of the responsibility placed upon us, and with a feeling akin to reverence heard the instructions which Major Reed had brought from the Surgeon General (Dr. Sternberg). They comprised the investigation also of malaria, leprosy, and unclassified febrile conditions, and were given with such detail and precision as only a man of General Sternberg's experience and knowledge in such matters could have prepared. . . .

July 2 we resumed our routine investigations, not only in Quemadoes, where the disease was being stamped out, but also in Havana at "Las Animas" Hospital and at Military Hospital No. 1, where my laboratory (the division laboratory) was located. There was no scarcity of material and the two members who until then had never seen a case of yellow fever (Major Reed and Dr. Carroll) had ample opportunities to become acquainted with the many details of its clinical picture which escape the ordinary practitioner.¹

The official history of this board records the fact that Dr. Carroll and Dr. Lazear volunteered to be bitten by infected mosquitoes. Dr. Lazear contracted the disease and died after a short illness. Dr. Carroll had a severe attack of yellow fever, a slow convalescence, and was permanently disabled thereafter because of involvement of the heart, from which he died some years later. Major Walter Reed died from appendicitis, Nov. 23, 1902, while Dr. Aristides Agramonte, the surviving member, is resident in Cuba, where he is engaged in scientific and professional work. All honor and glory to these physicians, to Private Kissinger (the first volunteer) and others, who in the interest of humanity and for the cause of science faced danger and even death, in order to make a demonstration of inestimable value to mankind. Many of the details of this fruitful work are recorded in several papers by General

1. *Scientific Monthly*, Dec., 1915, p. 216.

Sternberg,¹ and in a contribution presented posthumously at the Second Pan-American Scientific Congress, in December, 1915.

Perhaps the best summary of General Sternberg's relation to this important discovery is contained in the following abstract of a report of a committee composed by Drs. G. Wythe Cook, George M. Kober, and D. Olin Leech presented at the joint memorial meeting of the Medical Society and the Association for the Prevention of Tuberculosis of the District of Columbia, Jan. 19, 1916, in respect for General Sternberg.

Dr. Sternberg's investigations with reference to the etiology of yellow fever date back to 1871, although his search for the specific organism commenced in Havana in 1879, while a member of the Havana Yellow Fever Commission, and was continued for about ten years. During this time he twice returned to Havana during the months of yellow fever prevalence, and visited Rio de Janeiro and Vera Cruz, also the town of Decatur, Ala., during the epidemic of 1888. His report, published at the conclusion of these extended investigations, shows that all researches to that date had failed to demonstrate the specific cause of yellow fever. He showed that the generally accepted claims of Domingos Freire, of Brazil, to have discovered the germ of this disease—his *Cryptococcus xanthogenicus*—and a method of producing immunity by inoculations, had no scientific foundation. He also showed that the bacillus of Gibier, Carlos Finlay's *Micrococcus tetragenus febris flavae*, and the various microorganisms encountered by himself and by other investigators bore no etiologic relation to the disease. At the International Medical Congress, held in Berlin in August, 1890, Dr. Kober translated Dr. Sternberg's letter to Professor Hirsch, giving a synopsis of his work and stating that so far the specific organism of yellow fever had not been discovered. It certainly speaks well for his painstaking work that even now, when we know that the infectious agent is transmitted through the sting of a mosquito, and the search has narrowed down to the body of this insect, it has not been isolated and neither he nor others have found it, probably because it is ultramicroscopic.

Having exhausted the resources at his command in the search for the germ of yellow fever by microscopical examination of the blood tissues, by culture methods and by experiments

1. The Transmission of Yellow Fever, Popular Science Monthly, July, 1901. Sanitary Problems Connected with Construction of the Panama Canal, North American Review, September, 1902.

on the lower animals, he felt that the only method left which offered any promise of success was that of direct experiment on men. If the blood of a yellow fever patient contained the specific infectious agent, this should be shown by inoculating a nonimmune individual with such blood.

This line of research, we are informed, was pointed out by Surgeon-General Sternberg to Maj. Walter Reed, chairman of the Yellow Fever Commission in 1900, as was also the probability that it would ultimately be found that the disease is transmitted from man to man by an intermediate host.¹

In justice to all concerned it should be remembered that when this commission was organized by General Sternberg the claim of the distinguished bacteriologist Sanarelli to have demonstrated the etiologic relation of his *Bacillus icteroides* was generally accepted, and had been upheld by two medical officers of the Public Health and Marine Hospital Service, sent to Cuba for the special purpose of investigating this claim. To General Sternberg it appeared impossible that a bacillus, which is easily demonstrated under the microscope, and which grows in ordinary culture media, could have escaped his observation during his extended researches if it were in fact the specific cause of yellow fever. The only possibility of such causal connection seems to him to depend upon the identification of Sanarelli's bacillus as identical with a certain bacillus found by Sternberg in a limited number of cases during his researches in Havana. A comparison of cultures of the micro-organisms made by Major Reed at the Army Medical Museum and also by Dr. Agramonte,² 1899-1900, showed that they were not identical, and General Sternberg, being satisfied that Sanarelli's bacillus was not concerned in the etiology of yellow fever, organized in 1900 the Yellow Fever Commission, with Major Reed as chairman. Major Reed's investigation resulted in the

1. The written instructions are for obvious reasons silent upon the subject of experimentation upon man. Dr. Aristides Agramonte, a member of the Commission, in the *Scientific Monthly* for December, 1915, published a letter from Major Reed dated May 25, 1900, from which we quote the following: "It will be our duty under verbal instructions from the Surgeon-General to continue the investigation of the causation of yellow fever."

2. Dr. Agramonte worked on this problem during the Santiago Campaign in 1898 and afterwards with Reed and Carroll in the bacteriologic laboratory of the Army Medical Museum. He was ordered to Havana in December, 1898, with instructions from General Sternberg and power to do all that might be necessary to clear up the problem. In 1899, Drs. Geddings and Wardin submitted a report affirming that Sanarelli's bacillus was present in almost all the cases, while Dr. Agramonte denied that it had such specific character, and showed its occurrence in cases not yellow fever. He continued his researches until appointed a member of the Commission.

demonstration that in yellow fever the specific infectious agent is present in the blood of those suffering from the disease, and that the usual and probably only method of transmission of the disease is through the bites of mosquitoes of the genus *Stegomyia*. This brilliant demonstration by Reed and his colleagues has furnished the necessary basis for preventive measures which have been applied with entire success in the yellow fever zone, and the practical results are of incalculable value to mankind.

The members of your committee do not consider it unfair to the memory of Major Reed and his colleagues, when they declare that much of the success achieved was rendered possible by the preliminary work of Dr. Sternberg, who had eliminated numerous errors committed by others, and had contested and overthrown the claims of several bacteriologists for the discovery of the specific organism. His conviction that all former claims were unfounded, or remained to be proven, is clearly evinced by the appointment of a commission which he personally selected.

It may be truly said that no history of this important discovery is complete without a just presentation of Sternberg's preliminary work. In giving due credit to all the participants of this splendid piece of research, it must be remembered that all of his work was of the highest scientific value, and his daily contact with the sick, his autopsies and bacteriologic investigations in different countries and climes in search of the yellow fever organism, involved at least the same risks and heroism displayed by members of the Yellow Fever Commission.

In supporting the foregoing statement your committee submits the following testimony from Dr. Aristides Agramonte, the only surviving member of the Yellow Fever Commission, who, on Jan. 3, 1916, wrote to Dr. Kober as follows: "With regard to our work I may say that General Sternberg's instructions to Major Reed were so precise yet so complete that they embraced even human experimentation, a thing until then considered well nigh impossible, and, without the moral support which his reputation as a scientist of the highest order and his official position rendered us, I am sure we would have never undertaken the method of investigation with which you are familiar.

I feel in my heart that in the greatest achievement of modern medicine, the almost total extinction of yellow fever in our hemisphere, he took an important part that has not been generally recognized, in spite of your pointing it out in your speech (June 8, 1908).

I say an important part and I would be tempted to say the most important part, since by the elimination of many confusing and erroneous ideas with reference to the cause of the disease,

obtained by his indefatigable work in South America and Central America, he cleared the way for us who came after him, laboring in the same field of investigation; he saved us the work, and thus the waste of effort and time which it would have entailed, by dealing with the fallacies in vogue during the last quarter of the nineteenth century, elucidating the question of yellow fever in a manner nearly complete."

In addition to this just and beautiful appreciation of Sternberg's work we also refer to the following resolution, adopted Dec. 29, 1915, in which the section of public health and medical science of the Second Pan-American Congress "conscious of the irreparable loss suffered by the recent death of one of the most eminent workers in the field of etiology and preventive medicine, a pioneer in bacteriologic investigation in America

Resolved to express its profound condolence to the family of the late General George M. Sternberg, and to the Government of the United States, in whose army his counsel and labors were so fruitful."

It may not be amiss to quote from a letter from Hon. Elihu Root, one time Secretary of War, under whom General Sternberg had the pleasure of serving. This tribute was published in the Congressional Record, Aug. 5, 1916, fourteen years after the retirement of General Sternberg from active service, and it forms a just appreciation of the labors of those engaged in preventive medicine.

Dear Mrs. Sternberg: I have received your letter of March 6, and I respond heartily to the very moderate statements which you make regarding General Sternberg's merits and the claims of his memory to recognition by Congress. Senator Gallinger's bill does not rest alone upon long and faithful service, including both the Civil War and the War with Spain, but chiefly and distinctively upon the great part which General Sternberg played in the service rendered by the Medical Corps of the Army in the nine years during which he was Surgeon-General.

The practical extirpation of yellow fever in Cuba and on the Isthmus of Panama and the development of methods of preventive medicine which have secured the phenomenal freedom from typhoid in recent years are achievements in which the Medical Corps of the Army bore a great part and won the highest distinction. Congress has paid great honor to the medical officers who in the field and in the camp became distinguished for their part in this extraordinary work. Let no one think, however, that the man who was at the head of the corps can be left out of account of this creditable record. Such things do not happen by accident. No body of men

accomplishes what our medical officers accomplished except in response to leadership, incitement, encouragement, opportunity, motive power, coming from the head of the corps.

The Medical Corps accomplished what it did largely because the man at the top was a pioneer in bacteriology, an advance worker in protective medicine, and had the enthusiasm and devotion through which science wins victories. That spirit communicated itself to the corps, directed its energies, made the field of opportunity for scientific effort, kept good men in it, brought good men into it, and furnished the indispensable element of leadership without which the work could not have been done. General Sternberg was the general commanding in that campaign. Congress has been honoring his subordinates gratefully and properly. It is all wrong that there should be no appreciation for the commander. I have not received yet the copies of resolutions, etc., which you have sent, but I do not need them for I know about this subject myself upon the experience of four years and a half, during which it was my business to observe and estimate the influences working for and against efficiency in the War Department.

Dr. J. H. Gallinger, senator from New Hampshire, wrote under date of March 18, 1916:

I have read Senator Root's letter to you with the greatest interest. What he says about General Sternberg is the simple truth and I feel sure that the medical profession of the country would endorse every word of it.

Some details of the painstaking methods and the progress of the experimental investigations of the Yellow Fever Commission may be gleaned from the following letters of Major Reed to the Surgeon-General:

LETTERS FROM MAJOR WALTER REED

My Dear General Sternberg: Your favor of the 22d inst. enclosing a letter from Dr. Vaughan has been received. . . .

We arrived at this Camp, Monday afternoon, the 25th, and were soon comfortably provided for by Dr. Stark. We have already organized as a Board and have begun work. Yesterday we took careful cultures from two cases that have slightly passed the most active stage. Lazear has cultures from three autopsies to be worked up. This afternoon we will take cultures from the blood of a case admitted to camp hospital last evening and will continue to take cultures each successive day. We can get material from another case at the detention camp. Upon my recommendation, Agramonte appears to have adopted wise measures here. Lazear and I will go probably to Cienfuegos next week to look into an epidemic of malarial fever amongst

Second Infantry there. Our baggage (laboratory equipment) did not arrive on Sedgwick. Have asked General Humphrey to cable Q. M. General to have it forwarded by Ward Line of steamers. Please assist us at your end of the line.

Sincerely yours,

WALTER REED.

I have been unable to find any letters from Dr. Reed indicating the progress of the work of the commission between June 27, and October 22, but the official records disclose that three cases of yellow fever, believed to be the direct result of mosquito inoculations, were under observation. Two of the patients were members of the board, Drs. Jesse W. Lazear and James Carroll, who voluntarily submitted themselves to experimentation. Dr. Carroll suffered a severe attack of the disease and recovered, but Dr. Lazear fell a victim in the cause of science, Sept. 25, 1900. About the same time, nine other volunteers were bitten by mosquitoes; in these cases the result was negative. The results of the investigations by the Yellow Fever Board up to October 22, were presented in a preliminary note read by Dr. Reed at the meeting of the American Public Health Association at Indianapolis.

Indianapolis, Ind., Oct. 22, 1900.

Dear General Sternberg:

Just as I was leaving the city, I dropped you a postal suggesting that the words "with his full consent" be erased in the cases of Carroll (page 12) and Lazear (page 20), as their absence from the history of T. C. Y. might attract attention and lead to the inference that his inoculation was done without his consent. . . .

I will, also, ask that you will turn to the last page of MSS. (22) beginning "since we here," etc. Let the first paragraph stand as it is, but change the rest as follows:

From our study thus far of yellow fever, we draw the following conclusions:

1. *Bacillus icteroides* (Sanarelli) stands in no causative relation to yellow fever, but, when present, should be considered as a secondary invader in this disease.

2. The mosquito serves as the intermediate host for the parasite of yellow fever.

Strike out the remainder "and it is highly probable that" etc., as this is merely an expression of opinion which may

turn out to be right or wrong. Future observations can only determine this point—of course, conclusions 1 and 2 in your copy are to be erased entirely. . . .

Columbia Barracks, Quemados, Cuba.

Nov. 13, 1900.

My Dear General Sternberg:

. . . My voyage down was fairly pleasant, although I was as usual a victim to sea sickness. I have been very busy trying to get our experimental station started. Have secured a good location and hope to have the detachment go out on Thursday, 15th. I have already had three candidates to offer themselves for the mosquito inoculation and will have no difficulty in getting subjects for the infected bedding and clothing experiments. (I hope that you will not mention this to anyone). The difficulty before us now will be largely due to the marked change in the temperature. It is now 62°—with a strong north-west wind. Has been cold ever since I arrived. As the result of this past week's cool weather, cases have dropped from 100 to 76, and I suppose we may expect a still further reduction in about from 5 to 7 days. If it were only August 1, everything would be plain sailing, but I foresee that we will be much handicapped by the weather.

We will have our small experimental buildings heated, if necessary, and in that way, hope to counteract the outside temperature.

Dr. Carroll arrived this afternoon and will at once take up the work.

Nov. 26, 1900.

. . . At this writing, the experimental station is nearly completed and we have already begun on our observations. We have several individuals, American and Spanish, willing to take bites or blood injections, and we hope to be able to decide some of the vexed questions in the etiology of this disease. We anticipate considerable trouble concerning the rearing of our mosquitoes during this cooler weather. Unless we can keep them alive from eighteen to twenty-four days after the infection, we could not expect positive results, since it required twelve to sixteen days in the hotter weather of August to enable them to convey the disease.

Some of the Havana papers, especially *La Discusion* have abused us soundly and have charged us with all kinds of inhumanity and barbarity; but since the Spanish consul, a most courteous and intelligent gentleman, assures us that we shall have his support, as long as we do not use minors and the individual gives his written consent, I am not at all disturbed by these newspaper attacks. . . .

Dec. 14, 1900.

Within three weeks of the establishment of our experimental station, I am able to report two cases of yellow fever brought about by the bites of infected mosquitoes—one occurring suddenly at 11:30 p. m., December 8, and the second 9:30 p. m., December 12. Both cases have been seen and carefully examined by the board of experts, consisting of Drs. Guiteras, Finlay, Gorgas and Albertini, and both have been pronounced to be unmistakable cases of yellow fever. I thought it best to have these gentlemen of acknowledged experience see all of our cases. This they have gladly done, visiting our first case on the 9th, 11th, and again today. Although our second case is only in his second day, the symptoms are unmistakable. A third case bitten on the 11th at 4:30 p. m., began to sicken yesterday afternoon, with some fever and headache, and has, today, developed a temperature of 100.8°. I think that he will be removed early tomorrow morning, as his symptoms point plainly in that direction. Concerning a fourth case, bitten three days ago, it is as yet too early to pronounce an opinion. Our three nonimmunes have already passed fourteen nights in a house horribly infected with clothing and bedding without showing any symptoms whatever. Perhaps it is yet too early to pronounce an opinion as to the probability of their escape. Taken altogether, we feel very much pleased with our results, and believe that, with your kind permission, we should present a supplementary note to the Pan-American Congress in February next.

I am glad that our first case, now in his sixth day, is doing very well. It is too early to give a prognosis in our second case. In view of these results, I would like to know whether you consider it necessary that we should try blood injections, as you suggested when I last saw you. Any other suggestions that you may make, will be much appreciated.

Dec. 16, 1900.

I cabled you again, today, as I thought that you would be pleased to hear that success was still attending our efforts. Our fourth case sickened yesterday afternoon at 2:30 o'clock, and at 9 p. m., had a temperature of 104.2°. Four cases out of five inoculations is quite satisfactory, we think. This morning Drs. Guiteras, Finlay and Albertini were again here to see our third and fourth cases. Like the first two, the diagnosis was very plain and hence they very promptly pronounced the cases to be yellow fever, our first three we consider out of danger. The last man is still quite sick. Our third case was a very mild one. Although coming down four and one-half hours within the usual period of incubation—five days—he could have passed quarantine on the morning of his sixth day, and would

have been the focus of one of those epidemics ascribed to infected bedding, or the unpacking of trunk. For this reason, it is, to me, the most interesting case of the series. This week I hope to loose infected mosquitoes in our building No. 2, my intention being to demonstrate conclusively how a building becomes infected. Of course, every precaution has been taken to prevent the escape of these insects. My control subjects will keep on the uninfected side of the building, being protected by a fine wire-screen partition but breathing the same atmosphere. I have to ask as a special favor that Acting Assistant Surgeon R. P. Cooke, who so courageously volunteered to take charge of affairs in our horribly infected clothing building No. 1, may not have his contract annulled, but may be sent to duty in the Philippines, if he can not remain in Cuba. His interest in the work deserves, I think, this consideration from the Department.

The search for the parasite will be next in order.

Dec. 22, 1900.

I write to request that Dr. McConnell, of the Museum, may be sent down to join us on the next transport leaving New York. I would like to have him make drawings of the mosquito and larvae from live specimens. There is some other work here which he could also do. He should bring camera lucida and suitable paper for doing this work.

I would like also to be made a delegate to the Pan-American Congress, if you approve of our presenting a supplementary note at this meeting.

Jan. 1, 1901.

I am in receipt of your letter informing me that I would be detailed as a delegate to the Pan-American Congress, and thank you for the same. I am sure that you will be interested to know that our attempt to infect a new building by means of contaminated mosquitoes has met with complete success. The insects were released in this building during the afternoon of December 21. A few minutes thereafter I permitted a non-immune to enter and lie on a bed provided for the purpose. I, with other nonimmunes, stood in one end of the room, protected, of course, by a wire screen partition. The subject remained 30 minutes and was bitten by several insects. He again entered at 4 p. m. and remained 15 minutes; and again the next afternoon (22d) remaining 15 minutes. During each of which times, he was bitten by one or more insects. Four days later (December 25), at 9 a. m., he felt badly and had fever 99.6. At noon, a slight chill with rising temperature, 100.4—backache, headache, suffused face and infected eyes—at 9 p. m., temperature 104.2—albumen on second evening,

jaundice of eyes, etc.—typical symptoms of yellow fever, the diagnosis being confirmed by board of experts. His temperature fell to normal yesterday, sixth day, and patient will make a good recovery. It is hardly necessary to add that the two non-immunes who have slept each night in the noninfected end of the same room, only protected by a wire screen partition, are still well and healthy. Nothing could possibly be more striking than this observation. We shall make but few more experiments—one blood injection has given no result—we will make two others, if I can find the cases. I consider it now very important to find if possible the parasite in the body of the mosquito. We have preserved a number of insects of various ages for paraffin sectioning, when we return to Washington. I will, therefore, thank you very much if you will have the necessary order issued relieving us from duty at this post and authorizing our return to our proper station, so that we can start back immediately after the adjournment of the Pan-American Congress. I will request General Wood to retain the buildings at our camp site, so that, if necessary, we could resume our observations when the epidemic year begins again. Dr. Cooke's services at the Camp are now no longer needed. With greetings of the New Year,

WALTER REED.

P. S.: No results as yet in infected clothing building. Non-immunes sleeping every night in yellow fever beds.

Jan. 13, 1901.

Your letter of January 8, was received yesterday. I have made Carroll acquainted with the contents of your letter, and he wishes me to convey to you his sincere thanks for the honor which you propose to confer upon him. He will gladly remain in Cuba for a while, as you suggest.

It occurs to me that the passage of the Army Bill will promptly promote Major Kean to a majority in the regular Corps, and leave a vacancy for Carroll's promotion. If, however, the new Army Bill limits Surgeons of Volunteers to those who serve in the Philippines, Carroll would not care to go there. If it could be so arranged that he could return to Washington by April 1, I would be much gratified. I would suggest that the order for my own return and Steward Neate's be issued soon, that we could get our outfit on the transport ahead of us, and thus not be compelled to wait several weeks for important material. We could then leave immediately after the adjournment of the Pan-American Congress.

I feel certain that you will be much interested in the result from our blood injections. I think that I mentioned, in a letter, one case that had received a blood injection made on the first day of the disease. The result was negative in this case,

unless we regard slight headache and general muscular soreness, on the eighth and ninth days, as some manifestations of an attempt at infection. It is interesting to note that this same individual has since resisted the bite of mosquitoes that conveyed a good typical case of yellow fever to another non-immune. I am inclined, therefore, in the light of other injections, to look upon him as one having a natural immunity to the disease.

Having succeeded in getting hold of two hospital corps men, who were willing to take blood injections, we first infected a Spaniard by the bite of mosquitoes. During his primary paroxysms (first day) we injected 2 c.c. of blood from a vein at the elbow subcutaneously in one of our subjects. In just four days, lacking two hours, he developed an attack of yellow fever. From his vein, at the end of twelve hours (temperature 103.4°), we took 1.5 c.c. of blood and injected subcutaneously into second subject, resulting in a pretty infection in two days, twelve hours. Much to my regret we had no one for another injection. The parasite is therefore in the general circulation, and yellow fever thus follows exactly the modes of conveyance found in malarial fever. I have already saturated towels with blood of these cases and have put them in our infected clothing house. Probably nothing will come of this attempt to convey infection. We now have six successes out of seven attempted by means of mosquito bites (85.71 per cent.).

McConnell is here at work.

Jan. 27, 1901.

As McConnell has completed his drawings here, I have concluded to let him go on transport *Rawlins* which leaves today instead of waiting for the next boat. He carries with him a copy of our additional note with charts. I hope that Dr. Gould this time will return proofs to you so that corrections can be made before final publication. The article would be in time, if it appeared about February 10-15. I trust that what I have written may meet with your approval. I hope to leave here on Ward Line steamer leaving Havana, February 9. Have no order yet for Neate's relief from this station, but trust that it will come soon as well as order relieving Private Andrus and assigning him to Army Medical School laboratory. I will ask you to make a slight change in the wording of our eighth conclusion, so that the word "contaminated" be inserted before the word mosquitoes—so that it will read as follows: "A house may be said to be infected with yellow fever only when there are present within its walls contaminated mosquitoes capable of conveying the parasite of this disease." I will, also, ask that you change the relative position of conclusions No. 9 and 10, so that No. 9 will come last.

Jan. 31, 1901.

I cabled to you this afternoon, requesting that you delay publication of our additional note until you receive the copy which I shall mail in the morning. I have inserted a footnote of importance which I thought should accompany the note when published. Although our immune (mosquito made) cases, four in number, have shown no symptoms whatever, I am very uneasy about the nonimmune soldier who got the same quantity of blood (1 c.c.) at the same time. He seems to have acquired a very serious infection, his temperature running along the 104° line now for three days. Albumen appeared at the end of eighteen hours, but is not excessive. Should he die, I shall regret that I ever undertook this work. The responsibility for the life of a human being weighs upon me very heavily just at present, and I am dreadfully melancholic. Everything is being done for him that we know how to do.

This afternoon the Mexican delegates were here to see our cases and afterwards visited the experimental camp. They seemed to be wonderfully impressed with what they heard and saw. Please substitute the copy which I shall forward tomorrow for the copy McConnell brought. I will ask that McConnell change the period of incubation on chart No. 11 to five days, seventeen hours. Although the patient took to bed, complaining of headache, etc., at the end of four days, twenty hours, his febrile paroxysm did not begin till five days and seventeen hours. If you think that the disease begins with the advent of premonitory symptoms, you can let it stand as at present. I leave that to you entirely. I shall hope to leave on the *McPherson* about February 8.

Sincerely yours,

WALTER REED.

CHAPTER SIXTEEN

INSPECTION TOUR IN PHILIPPINE ISLANDS

President McKinley desired to obtain full information in regard to civil, military and health conditions in the Philippine Islands. He therefore advised a personal inspection by trusted staff officers and Representatives of Congress of existing conditions on the Islands. The president was especially anxious about the health of the army of occupation and naturally preferred that General Sternberg should represent the Medical Department on this inspection tour.

One morning soon after this request from the President, General Sternberg was summoned to give medical advice in regard to Mrs. McKinley. After his professional visit the conversation turned on the proposed journey to the Philippine Islands. The President asked if I was preparing to accompany my husband on the trip. General Sternberg replied he thought not; that I was planning to spend the time of his absence with my mother. The President intimated that he desired to see me, and I appeared at the White House in response to the invitation. Cordially greeting me the President solicitously inquired if I was going to the Philippines with my husband. I told him of my plan to go to the home of my childhood. He looked at me with expressive eyes, and said, "Your husband is going on a long, lonely trip and he will need you for company. Won't you go?" All of which led to my determination to accompany General Sternberg on his inspection tour.

Our journey to the Philippines lasted nearly four months. We sailed from San Francisco on the transport *General Hancock*, June 23, 1901. Owing to orders received by the officers in charge of the *General Hancock* just before the transport sailed, our route was changed, and we made the quickest trip that had been recorded by any government transport up to that date. But much to our regret, we missed Honolulu. When we crossed the 180th meridian, we naturally lost a day, and by peculiar coincidence this was July 4, not an inconsequential loss for patriotic Americans. Near the coast of Japan one of our lady passengers, who had previously been to China and Japan,

became very nervous in regard to typhoons. She was in constant dread of such an encounter. In the gray dawn of a coming day, on looking from the port hole of her cabin, she saw a black funnel-shaped object looming on the horizon, presenting to her excited imagination the exact appearance of the dreaded typhoon. It proved to be nothing more than two rock islands with high stony peaks, then used by Japan as a station for a penal colony.

MANILA

These islands are the first land seen from ships sailing to Manila by the northern route. We soon entered the China Sea, and later the monotony of the journey was broken by the view of the Island of Formosa; next by the coast of Luzon, along which we sailed for more than twenty-four hours before reaching Manila. On entering Manila Bay we passed Corregidor Island, towering 600 feet above the level of the sea, and the site of a fine convalescent hospital. To our right lay the historic naval station of Cavite and the wrecks of several Spanish ships of war, which had been destroyed at the time of Admiral Dewey's victory. Manila is built on low land, and from the deck of the ship we could discern only the larger buildings, the churches and other prominent points. At this date there was no breakwater in the harbor and the ship was obliged to anchor some miles from shore. The *General Hancock* was soon boarded by General Chaffee and his staff, who came to welcome the Adjutant-General and his staff, the Surgeon-General, the Commissary-General, and other general officers. A steam launch from the hospital ship *Relief* fortuitously came alongside, in command of Major Perley, Medical Corps. We had known him at home, and he offered the hospitality of his ship, assuring us we would be much more comfortable on board the *Relief* than at a hotel on shore.

I visited every part of the beautiful, clean, white ship, and I did not wonder that medical officers of the foreign armies in Chinese waters had agreed that she was the finest and most completely equipped hospital ship then in existence. We remained on the *Relief* for a day or two, General Sternberg making the trip to Manila in the steam launch. On the morning of the second day, General Sternberg went to make a call

on his brother, Major Theodore Sternberg, in command of the Quartermaster's steamer *Dix*, at anchor not far away. A little later as I was looking over the bay, I noticed the launch coming hastily back to the *Relief*. General Sternberg told me the typhoon signal was being displayed, and we must go ashore. We were quickly on our way in the steam launch, but I thought we should be swamped before we reached the shore.

Luzon is the most northern, as well as the largest and most important island in the Philippine group, on the southwest coast of which lies Manila, founded about 350 years ago (1571). Its architecture is not imposing, a factor not unrelated to the recurring earthquakes. The population of the city in 1901 was about 300,000; its shipping wharves were filled with hemp, sugar, tobacco, cigars, indigo, and coffee, with a large quantity of cotton goods.

About a week after our arrival we sailed around the southern islands on the transport *Lawton*. The bay was very choppy on the morning of our departure, and the hospital tug *New York*, assigned to take us to the *Lawton*, could not hazard the trip. We were, therefore, taken down the Pasig River to the Quartermaster's wharf and transferred to a much larger craft. As soon as we were on the bay, the waves began to break over the bow of our boat and the deck was constantly awash. By the time we reached the transport, most of the passengers were quite saturated. But the real excitement came when we attempted to board the *Lawton*. Men were on the platform of the gangway to assist the ladies, encouraging them to jump at the opportune moment when our boat was on the crest of a wave and not too far away from helping hands. There were many days at certain seasons of the year when it was impossible to board a vessel at anchor in the bay. At present, there is an extensive and substantial breakwater that protects ships at anchor and enables passengers to board with less fear and discomfort.

ILOILO

On leaving the bay we sailed in a southerly direction and were soon between the islands of Luzon and Mindora. During our whole trip we were never out of sight of land; on one of

the islands we could clearly make out the trees on the hill-sides and occasionally native villages and plantation houses. We hoped to see the volcano Taal in eruption, but in this we were disappointed. Our first stop was at Iloilo, on the island of Panay, the inhabitants of which are known as Visayans. They differ from their northern and southern neighbors in many respects, having made less progress in civilization and being less cheerful, more quiet and sullen than the Tagalos, the principal inhabitants of Luzon. The principal industry is weaving; the women generally make most beautiful fabrics. Almost every house contains one or more hand looms and such exquisite fabrics as *peña* and *jusi* are here woven. *Peña* is made from fiber of a plant resembling the pine-apple leaf, and is of such delicate texture that the doors and windows are kept closed during the process of weaving, lest a light puff of wind break or entangle the delicate filaments. *Jusi*, made from raw silk, all the material for ordinary clothing, quantities of coarse sacking for the transportation of the sugar crop, and beautiful sleeping mats, so largely used by the natives in their homes, are among the textiles manufactured by the Visayans. The natives are also very skilful in making bolos and other weapons of war, for which purpose they preserve all pieces of iron, from which they fashion good weapons and implements, tempering these by processes closely resembling those employed in more civilized countries. They have been forced to defend themselves for centuries against the attacks of their Mohammedan neighbors on the southern islands, and when well led they have always been able to make a good defense against Moro invaders.

From Iloilo, we drove to Molo, the center of the sugar industry, and a place of much wealth. The main object of our visit was the church, which is quite famous in these parts for a beautiful hanging lamp, its pictures and frescoed ceilings. These are supposed to be of a high order of merit and were done by a Filipino youth—born in this vicinity. Talent for art is much more rare among the Filipinos than that for music. Nearly every town of any size has its brass band, and very many of the natives play remarkably well on the piano and on stringed instruments.

CEBU AND MORO COUNTRY

Next in rank of Philippine ports is Cebu, the capital city of the island of the same name. The city dates to 1570 (one year before the foundation of Manila), is the center of the hemp industry, and does a flourishing trade in hemp and sugar. I had seen hemp growing in earlier days, and I thought I should see familiar sights. Not so, however, for the hemp grown in the Philippines belongs to another family, a plant that closely resembles the banana. But the most attractive of all the cities on our trip was Zamboango on the island of Mindanao. This, the second largest island in the Philippines, is inhabited principally by Moros, claimed by the Sultan of Jolo as his subjects, although his control is not very well established. The surgeon in charge of the hospital came out to the ship in a launch and took General Sternberg and myself to his quarters on shore. The Surgeon-General was greatly pleased with the results of his inspection for he found things in a very satisfactory condition. The building occupied as the hospital was the surgeon's quarters during the occupation of Zamboango by the Spanish troops, the old Spanish hospital being at the time of our visit occupied as barracks by our troops.

We saw the carabao, the patient and much loved beast of burden of the Philippines, drawing the plows in the deep mud of the paddy fields, while in other sections men and women were busy planting rice. There were large groves of coconut palms nearby, and in many of the gardens huge piles of the green nuts were lying. These are broken open and the dried meat constitutes the copra of commerce, one of the principal products of the tropical islands. The natives live in huts built on high supports of a framework of bamboo, thatched with leaves of the nipa palm. The floors are from ten to twelve feet above ground, and quite open to encourage free circulation of air. Housekeeping is reduced to its simplest forms and the complete culinary equipment of a Filipina consists of a few earthen pots, and one or two iron vessels. The dress worn by the Moros is quite distinct from that of the Visayans and Tagalos. The men wear closely fitting calico trousers, with gay, gaudy sashes about their waists. Picturesque ornaments adorn their hair, which is covered by a turban. Many of them file their teeth, and nearly all chew the betel, a habit which in time

stains the teeth a deep black. Some students were playing ball in the public square; they wore silk trousers with bright silk scarfs about the waist. The ball was made of thin strips of bamboo, shaped much like our base ball and evidently very elastic.

JOLO

We sailed for the mouth of the Rio Grande de Mindanao, and continued up the river to Cotta-Batto in a steam launch, with two life boats in tow, returning the same evening. On the following morning our steamer carried us where few American women had been before: to the harbor of Jolo, on the island of Sulu, where the sultan was at the time carrying on a war against two of his datos. We were taken to the home of the first secretary to the Sultan, an old man whose appearance was not at all prepossessing. His numerous wives were congregated in one large room, some of them displaying embroideries and native work for sale. It was announced that the sultan wished to pay his respects to General Corbin and the other officers accompanying him. The sultan's retinue was so large that a number were unable to get into the conference room, and they remained standing at the door and on the stairway. They were a picturesque looking lot. The sultan himself was a small man, apparently not more than 40 years of age, with a bright face and a keen eye. He did not speak any language but his own, but brought with him an interpreter. The sultan apologized for his personal appearance, saying he was in his field costume when he heard of the arrival of the American officers, and he had not taken time to change his dress. His costume consisted of the tightly fitting calico trousers and the bright sash common in the Moro country.

BAGUIO, BENGUET

On our return to Manila, General Sternberg made final arrangements for his trip to Baguio, Benguet. Reports had reached Washington of the desirability of establishing in that locality a health resort for officers and soldiers suffering from the effects of the tropical climate. The subject having been brought to the attention of the Secretary of War, Hon. Elihu Root, and a full report of the exact conditions on this mountain being desired, General Sternberg was instructed to make a personal investigation. At that date this trip was known to

be very difficult and fatiguing, including a long journey by horse over a rough mountainous country, through valleys with difficult sandy roads closely shut in by a growth of bamboo and other tropical plants. The first lap of the journey was made on the Dagupan Railroad. An accident on this road made quite an impression on General Sternberg; a carabao was killed by the engine of the train. Very soon, the family owning the beast came running to the scene and gathered around the animal, the women shedding tears while the little children patted and kissed the unfortunate carabao. From the appearance and demeanor of the family General Sternberg thought they must be losing their entire support. He therefore started a subscription to purchase another animal, and the sum contributed covered more than the price of a fine young specimen.

On his arrival at Benguet, General Sternberg was favorably impressed with the natural conditions. The site was on an elevation of about 5000 feet, studded with pine and oak trees and covered with short grass and tropical foliage. But it was extremely inaccessible, and he saw no way of occupying this otherwise desirable spot without building a good wagon road or a railroad to carry supplies. This could be done only at enormous expense, as conditions were not favorable. Despite all this, he constantly extolled the desirability of the site as a military reservation, and I have no doubt that his official reports did much to influence the building of the famous road to Benguet, which made possible the establishment of a health resort and convalescent home for those whom duty required to live in the Philippine Islands.

JAPANESE PORTS

On our return voyage we touched the excellent ports of Japan. Our ship entered the harbor of Nagasaki for coal. Only those who have gone into this port can realize what nature and man have done in making this picturesque spot of green cliffs surrounding a spread of deep clear water into one of the most beautiful harbors. Many tons of coal were put on board by the little Japanese women, who nimbly scaled a ladder with the coal in a basket on their backs, supported by a leather strap passing around the brow. In spite of their onerous task they seemed interested and contented and were very industrious and quick at work. I had never seen such

service being performed by women, except at Barbadoes, where ships are coaled by native colored women. On our trip out of the beautiful harbor into the Inland Sea, we passed hill-side gardens, terrace on terrace as far as the eye could see—an original example of intensive cultivation and a monument to the industry of the Japanese peasant. Kobe, our next port, has at present the larger part, if not the greatest value, of Japan's oversea trade, being second only to Yokohama, and many Englishmen and some Americans are here engaged in business. Our time was so limited that we hastened on to Tokyo, the capital of the Empire, where our party arrived after dark. The ladies of the party were placed in jinrikishas, while the men went in search of our light baggage. The streets were unusually dark, even for Tokyo, which at that time was not well lighted. Some one gave the word go, and the train of jinrikishas started, I alone in the front one. The man could not understand my directions to stop, but went at a good pace through a part of the big city where the streets were narrow and quite dark—not at all inviting. I could not see who was following me, and growing very nervous, I shouted for my husband, who soon appeared. The procession halted, and one of the officers was placed in the lead. It transpired that because of the lateness of the hour my "riksha" man was in haste to get to the hotel. He knew where he was going but I did not. Everybody thought the incident a good joke, and seemed to enjoy laughing at me. In short side trips we visited Yokohama, in many respects the most thriving and up-to-date port of Japan, and Nikko, scene of the most beautiful temple to be found anywhere in the Japanese Empire, erected to signalize the last resting place of the Shoguns, founders of the Tokugawa dynasty.

One evening, as we were sitting in the reading room at the hotel, we were surprised by quite an earthquake shock. Everyone seemed frightened and ran for the doors in order to escape into the open for fear it would be repeated, but no further quake came. However, a greater shock awaited us.

ASSASSINATION OF PRESIDENT MC KINLEY

Returned to our steamer at Kobe, a boat came alongside one day and from a messenger who had come out to meet a tea

merchant we learned that President McKinley had been shot at Buffalo, September 9, and that he was still living and making a brave struggle for life. I was at first skeptical of the accuracy of the report, but after I had received assurance that the press dispatch was reliable I was much distressed, for I knew it would be a great blow for General Sternberg. I broke the news to him as gently as I could, still hoping that it could not be true. More discouraging news came before we left Kobe, and as we walked the deck in the moonlight and gazed at the scenery without interest, my husband confided to me that if the report be true, there was little or no hope. The steamer sailed smoothly along through the Inland Sea, and we sat quietly on the deck, gazing now without interest on the scenes which were unfolded, for our thoughts were centered on the great misfortune that had befallen our nation. At Nagasaki, the news of the President's condition was not at all encouraging. We reached San Francisco a little before the scheduled time, and the pilot and newspaper men brought us the sad news that President McKinley had passed away, September 14, nearly a fortnight since. An irreparable loss to the nation and to us personally.

Mr. McKinley was the most widely loved man in our country at the time, and his death was deeply deplored. It has been said, and I think with justice, that there are "three chapters in American history, which stand out above all others. They are those that relate to Washington, to Lincoln and to McKinley. Washington created the nation, Lincoln preserved it, McKinley made it a leading world power."

We hastily made arrangements for crossing the continent and were glad to count the miles we were leaving behind us on our journey to Washington. We had scarcely arrived when General Sternberg received a message from Mrs. McKinley to visit her in her old home in Canton, Ohio. This he did as soon as possible, expecting to find her utterly prostrated by the great shock and her deep grief. She welcomed him cordially and although his presence must have caused her pangs of sorrow and brought thoughts of happier days, she spoke of much that had taken place since General Sternberg had been out of the country, and asked him to go with her at a fixed hour to visit the resting place of Mr. McKinley.

CHAPTER SEVENTEEN

RETIREMENT FROM THE ARMY

From May, 1893, until his retirement, June 8, 1902, the years were full of intensive work for General Sternberg. In addition to his official duties, he filled many positions of honor and trust and delivered numerous addresses on subjects on which he was well informed. Many of the illustrations which he used in his lectures were the work of his own hand, photomicrographs made in the years of his research on the organisms of infectious and preventable diseases. His address as the president of the Philosophical Society of Washington, delivered under the auspices of the Washington Academy of Sciences, Dec. 8, 1900, treated of the subject of malaria in a broad general way and introduced experimental evidence in support of the theory that the mosquito serves as the intermediate host for the parasite. This was published in the Smithsonian Institution report for 1900. Another notable address was that on preventive medicine, delivered at the opening of the postgraduate medical school of George Washington University.

Dr. Sternberg anticipated his retirement for age with mixed feelings of joy and sorrow. He was devoted to the welfare of the Army, proud of the progress made by members of his corps in scientific and practical work and he deeply regretted a severance of official relations. On the other hand, after a period of forty-one years in the service of his country, he naturally longed for rest, or at least for freedom from restraint. A man of his mental and physical activities could not remain idle very long, but there is a great difference between purely voluntary work and work done as a matter of duty or necessity. Hon. Elihu Root, Secretary of War, in recognition of his services, had recommended that he be retired with the rank of Major-General, a recommendation which met with the approval of the medical profession, as shown by the editorial comment of the leading professional periodical.¹

1. Surgeon-General Sternberg, editorial, J. A. M. A. 33: 1011 (April 19) 1902.

The Secretary of War has transmitted to Congress a recommendation that Surgeon-General Sternberg, when his active service is legally terminated next June, be retired with the rank of Major-General. This is endorsed by General Corbin, Adjutant-General of the Army, and with it is communicated a biographical sketch of Dr. Sternberg with a list of his leading contributions to medicine up to 1893. This naturally does not include some of Dr. Sternberg's best work, but it makes a showing that ought to convince congressmen that in thus advancing him a grade they are honoring one who has been an honor to his country as well as a faithful public servant for forty-one years, much of the time in arduous and perilous service in the field and on the frontier.

Indeed, we can say, without disparagement of any of his predecessors, that as a scientific medical man he has exalted the office of Surgeon-General of the United States Army and that at the present time we are not aware that such a position is anywhere held by any one of superior or even equal scientific reputation as an original investigator and authority. If, as General Corbin says, the Surgeon-General of the Navy was entitled by law to be retired with a rank equivalent to that of Major-General, by what rule of justice cannot the like officer of the Army, with a wider range of work and greater responsibilities, be retired with the same rank and emoluments? Dr. Sternberg's record is well known to the members of the medical profession, which has shown its appreciation by his election to many honorable positions and honorary memberships both here and abroad. The members of Congress can be assured that by the legislation requested they only carry out the wishes of the class of their constituents both in and out of the medical profession who can best judge of the propriety and need of such action. It is to be hoped that the recommendation will be promptly followed and the act made effective before the time of Surgeon-General Sternberg's retirement.

The United States Senate promptly passed the bill, and it was also favorably reported by the military committee of the House of Representatives. When called up under suspension of the rules, June 2, 1902, the bill was opposed from the floor of the House on the ground that it would afford a precedent for similar legislation in other cases, and it failed to receive the necessary two thirds vote. While the affair was a bitter disappointment to General Sternberg, he had the comfort of knowing that he enjoyed the respect and esteem of the medical profession, and this approval was of more value to him than

military honors or a financial competency. Among the greatest joys of his life were the commendations in editorial comments, such as the one quoted in the foregoing, and a letter from Dr. Biggs of New York requesting him to name a convenient date to attend a dinner to be given in his honor.

COMPLIMENTARY DINNER

DEAR DOCTOR: New York, May 17, 1902.

We feel that the retirement of Dr. Sternberg from the Army should not be allowed to pass without an expression on the part of his many friends of their appreciation of his long and faithful services to the country and to our profession. Entering the Army in 1861, Dr. Sternberg served through the Civil War, and rose by successive grades until in 1893 he became Surgeon-General, an appointment which recognized the merits of his special services to the corps. In this office he has borne great responsibilities and has improved in many ways the organization of the medical corps, notably by the establishment of the Army medical school.

In the work of the profession at large he has been deeply interested. Not only have his contributions to the science of bacteriology been important and numerous, but in this country he has, by strong personal efforts and by active work in our societies, stimulated the scientific study of medicine and fostered and encouraged those researches which in the case of malaria, yellow fever and other infectious diseases have proved to be of such enormous value.

During a long series of years Dr. Sternberg has been a warm advocate of all measures to promote the public health, and has unselfishly devoted much time to the work of national and local health societies and to the establishment of efficient legislation. His contributions to our knowledge of disinfectants are of special importance.

In recognition of his long-continued, varied, and important scientific and professional labors and of his high personal character the undersigned committee has tendered Dr. Sternberg a dinner, which will be held at New York, on June 13, and to which you are invited to subscribe. (Signed)

Henry D. Holton, Frank Billings, Simon Flexner, A. C. Abbott, James Tyson, J. C. Wilson, W. H. Welch, G. M. Kober, S. B. Ward, F. C. Shattuck, Maurice Richardson, Harold C. Ernst, Victor C. Vaughan, Surgeon-General Rixey, H. M. Hurd, Roswell Park, Lewis S. Pilcher, John A. Wyeth, Abraham Jacobi, Edward G. Janeway, Hermann M. Biggs, Surgeon-General Wyman, Charles G. Stockton, Lewis A. Stimson. Committee.

The following report of the dinner is from the *Medical News*, June 21, 1902.

It was a highly representative body that gathered last Friday evening at Delmonico's in New York to do honor and to pay homage to the retired Surgeon-General of the Army, George M. Sternberg.

DR. E. G. JANEWAY in his introductory remarks first read a telegram received from Maj. Gen. H. C. Corbin, U. S. A., in which he offered congratulations to Dr. Sternberg and his sense of appreciation of duty well done.

Further, in speaking of Dr. Sternberg and of his long life and many years of activity, Dr. Janeway remarked that on being retired at the age of 64 it could well be said that Dr. Sternberg did not retire on any grounds of insufficiency; he was not responsible for his date of birth and it was by an act of Congress only that he was forced to give up this particular line of activity. He expressed the hope, however, for this illustrious student of bacteriology, fellow of the American Association of Hygienists, commissioner on the study of yellow fever, author and worker, that many years would be left him in which he could carry on his work. Dr. Janeway said it was a matter of pride for the American physicians to point out the long list of achievements and attainments of their illustrious guest, which bespoke such a high mental endowment and was an evidence of work well done.

DR. ALEXANDER H. SMITH, in response to the toast, the United States Army, said that he had watched the career of General Sternberg and had shared in his honors, and throughout the Spanish-American War had felt great pride in his achievements. He had seen that the Medical Department was not second best, but first best, notwithstanding all the drawbacks, the results were more satisfactory and the criticism less than in any other department of the service, and Dr. Sternberg then and there demonstrated that a medical man might have executive ability outside his own lines.

COLONEL LIPPINCOTT of the U. S. Medical Corps said in part as follows: "The Army and his own corps gravitate toward General Sternberg; their respect and love reach out in his direction. The work that Dr. Sternberg had done, finding ten years ago the miserable old stuff left from the Civil War, in remodeling and reconstructing the corps so thoroughly and fundamentally was a matter to be proud of, and one is proud to have such a medical man in the Army; one honors the man who made it possible and owes him a debt of gratitude."

DR. WILLIAM OSLER of Johns Hopkins Medical School, speaking of the work of the Army in Cuba, said it was a happy expression, "Peace hath her victories no less renowned than

war." The Spanish War, he said, afforded an illustration not of prize-fighting, but of a great big giant pommeling a puny citizen affected with general paresis or Parkinson's disease; it was not a fight, he said, but a walkover. But there was another thing, another foe, worthy of the best of America's steel, and no chapter in the history of medicine will be able to stir the blood of the American profession as that which will tell of the battle with that foe, yellow fever.

He said it was a noble tale from the earliest history when Mathew Carey of Philadelphia, in 1793, first took up the work. Throughout the early history of medicine one reads the work of Rush and of Carey and the hosts of others who fought that foe. It has always been the same story in the Gulf States, the soul-stirring history of the men who laid down their lives in the struggle with this mighty adversary. Here was the foe that General Sternberg had fought and had vanquished; his name would go down to posterity with the honor of a battle long fought and valorously won. The victory, Dr. Osler said, was accomplished in a way that reflected great credit on the Army and on the medical profession. The work of Reed and Carroll was a piece of work well planned and well carried out, a demonstration to the entire world.

That, however, is not all of the story. Tuberculosis, typhoid fever, these are with us still. Never has there been an instance in the history of medicine when with such rapidity an organization had been able to wipe out a scourge. That work had been carried on by Dr. Leonard Wood and Dr. William C. Gorgas.

DR. W. C. GORGAS [lately Surgeon-General, U. S. Army] said that had their work not been so successful as good fortune had made it, General Sternberg would have received the entire blame, the success was his also. When Havana was occupied in 1899, he became health officer in the spring with no very clear idea of what to do, and at first he had devoted his attention to the organization and development of a sanitary department; work was started in on all lines, good as well as bad, bad as well as good. There was little yellow fever in the spring of that year, but in the fall and winter there was a great deal. In 1900, though the general sanitary condition had immensely improved, the yellow fever was still present and the epidemic was of a severe character. There were over 1,400 cases and 300 deaths, and he felt discouraged at the little progress made. In 1900 Dr. Reed, chief of the bureau, first directed work along the lines of the theory of the mosquito infection and he proved, as history now so well knows, that the mosquito can be infected only during the first three days of the disease, and that there is a period of from twelve to twenty-five days when the bite of the stegomyia can convey the disease.

About this time the Sanitary Department was organized and turned its attention to study the local conditions and their relation to the spread and development of the mosquito. The rain barrels, the family cisterns, all breeding *Stegomyia*, the Chinese gardens from which came *Anopheles*, all these were studied in much detail and a force of 150 men was put to work. There were but few cases of yellow fever at the time and the mosquitoes of the neighborhood were killed by fumigation, pyrethrum powder proving a very efficient mosquitoicide. In January of 1901 the city was free from yellow fever; in July the suburbs received a certain amount of reinfection, but on Sept. 28, 1901, the last case of yellow fever occurred. Since that time the land has been practically free, since Havana has been the center of infection. The success had been due to the study of the mode of propagation, which discovery had been made possible by the enthusiastic cooperation of General Sternberg.

DR. WILLIAM H. WELCH of Johns Hopkins Medical School spoke of that side of the work of Dr. Sternberg which was most familiar to him, namely, his work in bacteriology. Dr. Sternberg, he said, was the pioneer worker in bacteriology in this country; he had been compelled to acquire the technic from reading and the entire world knew how he had perfected a technic equal to that of the best. Dr. Sternberg had made many important discoveries; his work on disinfection and disinfectants would stand as a monument alone. As the first worker to isolate the micro-organism of pneumonia he had gained renown, and his work with yellow fever would stand forever.

He said that it was a common thing in these busy days to forget the steps which led up to any important discovery. All that Dr. Sternberg had done in the study of yellow fever was necessary work and it had to be done in just the way that he did it. The ground had first to be cleared; if it were not so the discovery had not been possible, and later discoverers themselves would have had to hunt out the large number of micro-organisms which Dr. Sternberg had described and laid aside.

His careful work had practically resulted in the view that a bacteriological origin for this disease could not be claimed, and it was on *a priori* grounds that he himself had felt that Sanarelli's bacillus was not the cause of yellow fever. Dr. Sternberg's studies of others' discoveries were most careful and most critical; it was not wasted endeavor. The problem still remains, however, what the cause of yellow fever is, although the method of eradication has been demonstrated in a most complete and authoritative way.

Dr. Welch expressed the wish that Dr. Sternberg would come back to his old love, and to his test tubes, and he welcomed him to many years of fruitful work in a field that had always claimed him as peculiarly its own and one in which honor and renown had been won at home and abroad.

GENERAL STERNBERG responded as follows:

Gentlemen: Words fail me in which to express my high appreciation of the compliment you have paid me by making me your guest of honor upon this occasion. Such a compliment coming to me from the leading members of the medical profession at a time when by the operation of law I have reached the end of my active service as a medical officer of the Army, is especially gratifying. Accepting this testimonial as evidence of your approval of my efforts for the promotion of medical science and of the interests of the Medical Corps of the Army, I thank you one and all most sincerely. At the same time I feel that the results accomplished have fallen much below my earnest desires and perhaps have not been commensurate with the opportunities I have had.

My first feeble efforts in the field of investigation which has always presented the greatest attraction for me—the etiology and prevention of infectious diseases—were made at a time when no one in this country was prepared to give me instruction in methods of research and I was to a large extent thrown on my own resources. The tubercle bacillus, the typhoid bacillus and many other well-known pathogenic micro-organisms had not yet been discovered and a most promising field of investigation was presented to my view, for I was strong in the belief that infectious diseases must be due to infectious agents capable of self-multiplication, *i. e.*, to living disease germs. It so happened that the principal problem which I was called on to solve was one of the most difficult that has engaged the attention of investigators, and one in which bacteriological methods have proved to be of no avail except in establishing a negative proposition, *i. e.*, that yellow fever is not due to a micro-organism of this class. The time and persistent work devoted by me to an investigation of the etiology of this disease might have given more fruitful results if my attention had been turned in some other direction, but while I met with a serious disappointment in my failure to discover the yellow fever germ, I have the satisfaction of knowing that my researches cleared the way for the subsequent demonstration by Reed and his associates, of the method by which this disease is transmitted from man to man. From a practical point of view this is all we require to guide us to successful measures of prophylaxis, as has been recently demonstrated in the Island of Cuba.

But I must not occupy your time by further reference to this portion of my life work. For nine years I have scarcely looked through a microscope, my time having been fully occupied by the important duties entrusted to my charge as Surgeon-General of the Army. While I have not been able personally to prosecute any research having in view the advancement of medical science, it has been a source of great satisfaction to me that I have been able to provide the means and appliances for other medical officers of the army to do so. When I commenced my research work I had to provide my own microscope and material of all kinds. There not only was no bacteriological laboratory or apparatus at any military post, but so far as I am informed none at any medical school or university in the country. At present we have a thoroughly equipped laboratory in connection with our Army Medical School in the city of Washington, at all of our general hospitals in this country and in the Philippines, and also at every military post of any importance throughout the United States. We also have a considerable number of medical officers who have been instructed at the Army Medical School, which I established in 1893, who are well prepared to take advantage of their opportunities for research work.

The Medical Corps of the Army is today in a high state of efficiency and I am proud to have been the Chief of this *corps d'élite* during a period when its efficiency and usefulness has been put to so severe a test. The profession, also, has reason to be proud of its members who are attached to the military service of the country. Our senior surgeons have been called upon to fill positions of great trust and responsibility during the past four years and have, as a rule, acquitted themselves with great credit. As Chief Surgeons in the Philippines, in Cuba and in Porto Rico, they have been to a large extent responsible for the administration of the affairs of the Medical Department, and have been called upon not only to protect our troops from the ravages of infectious diseases but to perform a similar service for the natives of the various islands in which American soldiers have been called upon to serve. In all of these islands we found smallpox to be widely prevalent and in all it has been practically stamped out. In Cuba yellow fever was a scourge which threatened to do us greater injury than the bullets of our foes. But thanks to Reed and his colleagues on the board sent to study this disease, we now know how to prevent its extension and have practically stamped it out in the city of Havana, which has for many years been its principal endemic focus in the West Indies. In the Philippines bubonic plague has been kept in check by the

strenuous exertions of our medical officers and the latest reports indicate that it has almost disappeared from the city of Manila. Unfortunately Asiatic cholera has recently gained a foothold in Manila and the neighboring provinces. Colonel Maus, who is at present acting as Commissioner of Public Health, is fighting this scourge with every means known to science and hopes to be able to avert a serious epidemic.

Time will not permit me to dwell further upon the achievements of our medical officers during and since the Spanish-American war, but I make bold to say that as sanitarians, as surgeons, as all-round practitioners of medicine, and as scientific investigators, we have in our ranks many medical officers who are an honor to the Corps and to the profession.

I also point with pride to our general and post hospitals. The general hospitals at the Presidio, at Fort Bayard, at Washington Barracks, and at the Hot Springs, Ark., are models which bear comparison with the best civil or military hospitals in any part of the world. In this country nearly every military post of any importance has a modern hospital well adapted to the requirements of the military service, provided with a well-equipped laboratory for clinical and research work, and an operating room which would be regarded with satisfaction by any surgeon accustomed to the precautions necessary for successful aseptic surgery.

When I graduated in medicine in the College of Physicians and Surgeons in this city my ambition did not extend beyond the hope of securing a living practice in the country. My first venture was at a little town on Long Island, where a vacancy was supposed to exist owing to the recent death of an old and highly respected physician. Apparently I was not able to fill this vacancy for my professional shingle was displayed for several months and I did not receive a single professional call. Not being appreciated in this conservative neighborhood I moved my base of operations to Elizabeth City, New Jersey, and was getting a little practice when the war tocsin sounded and my future career was determined by the favorable verdict of an army medical examining board as to my qualifications for duty as an army surgeon. Within three months I was engaged in infecting gun-shot wounds with dirty fingers and unsterilized cold water dressings, and in amputating the legs and arms of unfortunate soldiers who had sustained gun-shot fractures in the disastrous battle of the first "Bull Run." We were all blissfully ignorant of pathogenic micrococci and bacilli in those days, but having had Willard Parker as my professor of surgery, and Dr. Sands as demonstrator of anatomy, I was not entirely unprepared for the responsibilities of the battlefield.

It would perhaps have been more profitable if I occupied the time at my disposal upon this memorable occasion in speaking in some detail of the advancement of medicine and surgery since my student days; but most of you are better qualified to discuss this interesting topic than I am, and I am sure you will pardon me if my remarks have been more or less personal and reminiscent in character. I find it hard to realize that the country youth of my name who came to this city as a student of medicine in 1858 is here today as the honored guest of leading members of the medical profession in the United States, whose names are as household words wherever students of scientific medicine are assembled.

I thank you, gentlemen, again and most sincerely for this kind testimonial of your esteem. Your endorsement of my life work is of more value to me than military honors or financial competency. I have at times felt discouraged and disposed to think that I have fallen far short of what might reasonably have been expected in view of my opportunities. But it is reserved for the very few to accomplish great things and the physician who has won the esteem of those of his profession who are best qualified to judge of his work may well be satisfied although he realizes that he has had but a small share in promoting the advancement of scientific medicine and the interests of our beloved and humane profession.

COMMENDATORY LETTERS

In the following communication from a member of General Sternberg's official family his chief attainments as Surgeon-General are summarized:

Dear Mrs. Sternberg:

I am greatly pleased to learn that you are preparing a biography of General Sternberg, and venture to take this opportunity of writing you the point of view of a medical officer regarding General Sternberg's high motives and attainments.

As you know, General Sternberg just at the close of the Spanish-American War ordered me to the command of the Army General Hospital at Washington Barracks, Washington, D. C., and thereafter, until the General's retirement in 1902, I was practically a member of his official family, for as commandant of a general hospital I reported directly to the Surgeon-General, having no other superior officer.

When the Army Medical School was reopened in 1900, he had me appointed professor of military surgery in that institution, and as result of holding the hospital and school positions I was brought very intimately in contact with the General, few days passing in which I did not see him for direction, advice or adjustment of some one of the many matters arising particularly from the conduct of the hospital.

Of General Sternberg's pioneer work in bacteriology and of his professional attainments, others are better qualified by direct observation to speak, but the result of his profound comprehension of the professional need of the Medical Corps was felt by me and others of the corps long before I served directly under him. Prior to his appointment to the Surgeon-Generalcy, through lack of foresight and failure to appreciate the crying need of allowing members of the corps the means of professional advancement and stimulating them to individual endeavor, the corps was undergoing a process of internal dry rot and official discouragement. With this General Sternberg was himself familiar, having had to pursue his researches and having reached his eminence in science by working under those discouraging conditions, not only without support from those in authority, but indeed often under press of indifference if not of active or passive opposition.

But General Sternberg had such high appreciation of the mission of medicine as a science, that when called to the Surgeon-Generalcy he swept away all existing reactionary methods and inaugurated a new era in the history of the Medical Corps. The young men of the corps of which I was then one, at once felt the change.

Recent medical publications and periodicals, laboratory apparatus and operating room appliances were furnished and members of the corps were encouraged and expected to keep up with the advance of medicine and surgery. General Sternberg was the first Surgeon-General who fully appreciated the professional as well as the official aspects of his office. He raised the corps from medical obscurity to a definite and creditable place. He did this not only by installing many basic improvements but by encouraging instead of repressing individual effort. No better example of this is afforded than the career of Walter Reed. To Reed he first gave the opportunity to study bacteriology, then a professorship of that subject in the Army Medical School, and finally occasion to make the great discovery of the way of transmission of yellow fever, by appointing him to head the Yellow Fever Commission which, following the road cleared by the bacteriologic work of General Sternberg, led to Reed's great discovery.

Instead of turning over attending surgeoncies in cities to personal or political favorites, General Sternberg gave these services with their opportunities for study in turn to the medical officers who showed themselves professionally capable of utilizing them. By the establishment of the Army Medical School, he founded an institution of incalculable value to the educational and research advancement of the Medical Corps.

Prior to his time general hospitals in the Army had been held for war purposes only, and with the coming of peace were

discontinued. General Sternberg saw the great possibilities of these hospitals, where with complete plants, fully equipped with modern appliances for diagnosis and treatment and manned with specialists, cases difficult of diagnosis and requiring special treatment could have all the resources of modern diagnosis and therapy. With this in view he established the hospital for tuberculosis at Fort Bayard, continued after the war with Spain was over, as also the general hospital at San Francisco, Calif., and the general hospital in Washington.

He saw the great possibilities of a general hospital in the National Capital, where there would always be a large clientele for treatment, where a general hospital would always be needed in case of future war, and where it could be used for clinical and research purposes in connection with the Army Medical School. It was in line with this that, as commandant of the hospital, I was put in charge of military surgery at the school, so that the didactic and theoretical work of military surgery could be supplemented by practical clinical and operative work at the hospital.

Many officials not as farsighted as General Sternberg desired and attempted to have the general hospital discontinued, arguing that with the end of the war the need was past, and they were entirely unappreciative of the even greater need for continuance in peace, a need which has been so well proved by the development of the old hospital into the Walter Reed General Hospital which has been of such great use in the great war, and in connection with which the new Army Medical School buildings are to be erected. In my position under General Sternberg, when submitting matters relative to the development and conduct of the hospital, its connection with the medical school and its usefulness to the military service in general, I found him always actuated by the highest and most comprehensive ideals. For this reason he was able to unite all those policies which have been basic in the development of the Medical Department of the Army. He was not an opportunist, but a clear sighted, deep thinking scientist. His policy once decided on, he pursued his course unfalteringly. Equally unfaltering was his support of his subordinates in all matters in which support was warranted. I came to know through many personal experiences arising from the conduct of the general hospital, that General Sternberg could always be counted on unflinchingly to support his subordinates in all matters which concerned the dignity and the official status of the Medical Corps, which made the corps or its individual members more efficient, which advanced the general good of the service or advanced medical science.

General Sternberg was the pioneer in professional advancement in the Medical Corps of the Army. It will be fortunate, indeed, should he have successors as kindly, as capable and with as great a grasp of the high mission of medical science.

WILLIAM CLINE BORDEN,
Lieutenant-Colonel, U. S. Army (Retired).

The following letter from the Secretary of War was addressed to General Sternberg on the occasion of his retirement from active duty in the Army.

WAR DEPARTMENT
Washington

December 15, 1903.

My Dear General Sternberg:

I thank you very much for your photograph. I have asked Mr. Chance to get your signature upon it. It will represent for me a very delightful association with an officer whose scientific attainments and devotion to the public service entitle him to grateful recognition. I shall always be proud of the achievements of the Medical Corps of the United States Army under your administration.

Always faithfully yours,
ELIHU ROOT.

Brig.-Gen. GEORGE M. STERNBERG,
Washington, D. C.

Shortly after General Sternberg's retirement we exchanged our home on Sixteenth Street, N. W., for a home on California Avenue, with space for a garden. It was here we enjoyed many days and hours of great happiness. We had some fruit trees, flowering bushes, and a beautiful green turf of blue grass. General Sternberg always had a love for flowers and had cultivated them in our surroundings in all of our Army homes, and now, relieved from all official cares and in need of recreation, he transferred his affections to his home with its extensive grounds. He planted rose bushes and flowering shrubs, and was compensated for his labor by splendid returns of beautiful roses. During this time he was engaged in the preparation of his work on *Infection and Immunity*, with special reference to the prevention of infectious diseases, which was published in 1903. He was not left long in the pursuit of absolute leisure, for demands for his professional interest

came to him in numbers. He soon found himself again a rather busy man, occupying the chair of preventive medicine in the graduate school of George Washington University and taking an active part in the antituberculosis campaign, and in other philanthropic and social endeavors.

CHAPTER EIGHTEEN

HUMANITARIAN INTERESTS

Few men in the last decades of history have performed more beneficent work in pure science than General Sternberg, and a review of his work in his creative years will bear out this assertion. He had a natural taste for scientific research, but he always sought the practical application of science to the amelioration of human ills. His first important work in the field of bacteriology was that on disinfectants and disinfection as a means of preventing the so-called germ diseases. He never lost an opportunity to impress on the public that the eradication of preventable diseases is the highest aim of scientific medicine. At an early period of his investigations he conceived it his duty to educate the public in a knowledge of the causation and prevention of disease.

It was not possible for a man of General Sternberg's interest in humanity to remain inactive when much remained to be accomplished in matters of sanitary reform. In company with other men, trained in practical sanitation, notably our friend, Dr. G. M. Kober, whom we first met at Fort Walla Walla in 1877, he saw great opportunities for improving conditions. Men deeply interested in preventive medicine cannot be content with the scientific knowledge that unsanitary houses are largely responsible for the prevalence of tuberculosis, or that polluted river water and impure milk are potent factors in the spread of typhoid fever; they must make practical application of this knowledge. It so happened that in 1896 General Sternberg was a member of the committee on permanent relief of the poor in the District of Columbia and Dr. Kober was chairman of the committee on sanitation of the Civic Center. Both were deeply interested in the purification of the water supply, the improvement of market milk and the removal of the slums, and their positions gave opportunity for cooperative efforts in this field.

The committee on housing of the Civic Center submitted a report of its survey, Jan. 12, 1897, while General Sternberg's committee made a preliminary report, Jan. 27, 1897, of which the following is an extract:

Our investigations show that a large proportion of the indigent population of Washington are housed in tenements located in alleys of the city; that many of these alley houses are unfit for human habitation; that the majority of them are not supplied with water and have no sewer connections; that many of the houses and the yards attached to them are in a very insanitary condition; that typhoid fever and other infectious diseases cause a considerable mortality in these alley houses as a result of such insanitary conditions; that the sanitary inspection service of the health department is entirely inadequate and that it is not in the power of the district commissioners or the health office of the city to remedy these evils under existing laws and circumstances.

This state of affairs is a disgrace to the national capital, and in our opinion calls for legislation by the Congress of the United States by which the district commissioners may be enabled to condemn and destroy tenements which are unfit for human occupation, to condemn and pay for buildings and ground required for the purpose of widening alleys, and opening blind alleys, conformably to existing laws, to construct branch sewers and introduce water and gas, so that sanitary tenements may be erected on these minor streets or alleys which can be rented to the poor as low or lower than are the insanitary dwellings now occupied by many of them.

The committee on housing of the Civic Center, consisting of Miss K. P. Hosmer and Messrs. Henry Gannett, G. W. Hanger, G. A. Weber and George M. Kober, chairman, after setting forth the facts revealed by a general survey, submitted the following recommendations:

1. The speedy conversion of all alleys containing a sufficient number of human habitations into minor streets and places.
2. When impracticable to extend or cut through the blind alleys from north to south or from east to west and to widen them at least to 30 feet, they should be condemned as unfit for human habitation.
3. All alleys and alley houses should be subjected to a searching official investigation, the houses should come up to a reasonable sanitary standard and dwellings unfit for human habitation should be condemned.
4. The attention of capitalists should be drawn to the fact that no class of realty pays as well as alley property in this city, and that there is a splendid field for investment in the erection of sanitary and comfortable alley houses on a business and humanitarian basis.

General Sternberg's committee said:

We concur in general with the recommendations recently made by a committee of the Civic Center of this city and desire to call special attention to the fourth and concluding recommendation of this committee submitted, Jan. 12, 1897.

For the purpose of securing prompt action in accordance with this recommendation, the committee suggested a plan for the organization of a company which would interest capital in sanitary housing for wage-earners.

WASHINGTON SANITARY IMPROVEMENT COMPANY

In February, 1897, the Civic Center in conjunction with the Board of Trade of Washington, the Central Relief Committee, and the Woman's Anthropological Society, held a public meeting at the Foundry Methodist Episcopal Church on the subject of housing the wage-earners, which was addressed by Dr. E. H. L. Gould of New York, Bishop Satterlee, General Sternberg, Mr. John Joy Edson, and others. Another meeting was held under the auspices of the Board of Trade, March 26, 1897, at the Builders' Exchange.

In the meantime, sufficient stock had been subscribed to justify the organization of a company, and a committee consisting of Messrs. C. C. Cole, A. Y. Worthington, Nathaniel Wilson, George M. Sternberg, John Joy Edson, S. W. Woodward, George L. Andrews, B. T. Janney and George M. Kober was instructed to obtain articles of incorporation, which were granted under the laws of the state of Virginia, April 14, 1897.

At the first meeting of the directors, General Sternberg was elected president; Mr. S. Walter Woodward, vice president; Dr. George M. Kober, secretary, and Mr. John Joy Edson, treasurer.

While the original intention of the organizers was to provide homes for the alley residents with a view to removing the slums, it was considered best to begin by providing improved dwellings for the better class of wage-earners so that houses vacated by them might be rented by the next grade and so on until the bottom of the ladder was reached. Had the company acted otherwise the undertaking would probably have resulted in failure. As it is, it has established a standard of sanitary homes at reasonable rentals, which other landlords are obliged to adopt, or the company will supply the demand.

The plans of the apartments, largely General Sternberg's own work, were for him a source of great pleasure and relaxation. In this, as in all his other work, I had tried to show an interest, and I recall that he was wont to say that Mrs. Sternberg and Dr. Kober insisted there should be no common architectural features, and that each of the two-story apartments should have separate entrance, exits and yards.

By rigid economy and careful business methods the directors were able to pay a dividend of 5 per cent. per annum from the very inception of the enterprise. The company continued to erect homes from year to year, and in 1900 was awarded a gold medal at the Paris exposition, the only company of the United States to receive that award. Gold medals were also awarded to General Sternberg, president, and to Dr. Kober, secretary. The company now owns 312 houses occupied by 624 families, and its assets, March 31, 1918, were \$774,661, with a surplus over and above liabilities of \$274,661.09 (over 50 per cent. of the original stock issued).

WASHINGTON SANITARY HOUSING COMPANY

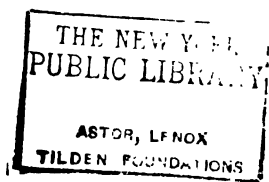
General Sternberg, to whose zeal and energy the success of the improvement company was largely due, felt that a 5 per cent. investment could not directly benefit the day laborers, laundresses and other humble wage-earners. In the interest of the health and morals of this class, he determined in the early part of 1904 to organize a new company with dividends limited to 4 per cent., and secured a charter from Congress, April 24, 1904.

In the language of General Sternberg, the object of the new company was:

To build sanitary houses for a deserving class of the population which cannot afford to pay the rentals, which the better class of wage-earners pay for the flats of the Washington Sanitary Improvement Company. To bring the rentals within the reach of this class it is necessary to build on cheaper land and to leave out certain features (bay windows and cellars) which add to the expense of construction. It is not proposed to provide for the idle and dissolute, and only those who pay their rents and take reasonable care of the apartments will be retained as tenants.



Medals Awarded to GEORGE MILLER STERNBERG.



In May, 1904, the company purchased ground and built twenty houses, which were occupied in October of the same year. These houses are now rented by respectable colored tenants, who pay \$7 a month for three rooms and bath, or \$8 a month for four rooms and bath. It was regrettable that the subscription to the stock of the new company during the first two years was very small and came mostly from contributors to charitable and uplift work. Since philanthropy and 4 per cent. apparently were not attracting sufficient capital for the expansion of the work, General Sternberg had the charter amended so as to permit the payment of 5 per cent. dividends.

At the time of General Sternberg's death, the company owned ninety-seven houses, accommodating 194 families, with assets of \$244,418 and a depreciation fund of \$20,973.

General Sternberg was also very active in an effort to secure a law compelling the proper repair or removal of dwellings unfit for human habitation. The original bill was drafted by him in 1897, but because of the opposition of interested parties and on account of the inertia of a few congressmen, who objected to this measure on constitutional grounds, it was not enacted into law until May 1, 1906. Since the latter date, 2,082 houses have been demolished as unfit for human habitation and 1,592 houses have undergone compulsory repairs to place them in a sanitary condition. Coupled with this work, he took a lively interest in appropriations for the health department, as well as for the conversion of inhabited alleys into minor streets. He very properly emphasized on occasion that no matter what might be accomplished by legislation in the elimination of the alleys "it should be remembered that the evil of overcrowding will only be transferred to other localities outside of the alleys unless a sufficient supply of houses at low rentals is in some way provided for unskilled wage-earners of this city." Fortunately, the success of the two housing companies stimulated private enterprise and resulted in the erection of thousands of so-called two-story sanitary flats at reasonable rentals.

ANTITUBERCULOSIS WORK

Having been the first in America to demonstrate the tubercle bacillus discovered by Koch in 1881, and being perfectly familiar with the causes and prevention of pulmonary tuber-

culosis, it was natural that General Sternberg should labor long and faithfully in the campaign against this disease. He was a charter member of the National Association for the Study and Prevention of Tuberculosis, and president of the Society for the Prevention of Tuberculosis in the District of Columbia, from 1908 to 1915. In public addresses on the housing and tuberculosis problems he often pointed out that as regards pulmonary tuberculosis, Washington had the disgraceful mortality record of 305 per hundred thousand of population, leading all other cities in the United States, with the exception of Denver and Los Angeles, to which cities unfortunate victims of this disease resort in large numbers from all parts of the country.

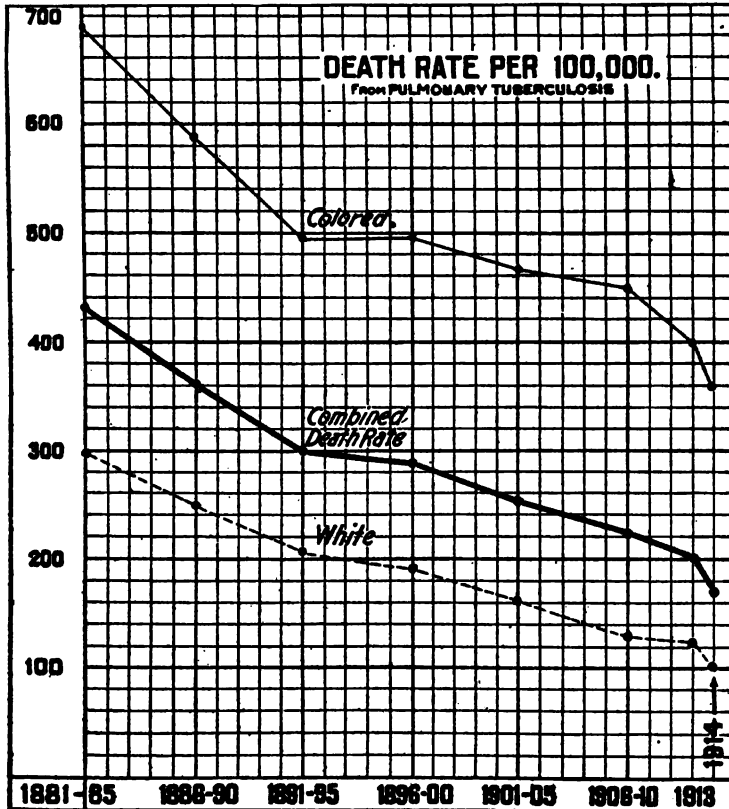
He knew from personal inspection and from records of the health department that the blind alleys in which a large proportion of the poor of the city lived in overcrowded and unsanitary houses, naturally favored the development of tuberculosis and other infectious diseases. To quote his own words:

Insufficient ventilation and insanitary surroundings reduce the vital resisting power of individuals exposed to such conditions; overcrowding causes closer contact with the infected individuals, and the absence of sunlight prevents the destruction of disease germs by nature's principal disinfecting agent. The tubercle bacillus is quickly killed by exposure to sunlight, but many germs survive indefinitely in dark and damp places.

He emphasized the fact that the mortality from tuberculosis was more than three times as great among the colored population as among the white, largely because they occupied the most unsanitary alley houses. He made it clear that much good could be accomplished by social service workers and visiting nurses, in pointing out the danger of ill ventilated rooms, improper food and impure milk, and that very much depended on the intelligent activities of the health department—supported by adequate appropriations, proper sanitary regulations, and an ample corps of inspectors.

There is reproduced herewith a chart showing the result of excellent leadership in the antituberculosis campaign in the national capital, pronounced by Prof. William H. Welch (in a private letter dated April 10, 1910), a very impressive and remarkable object lesson. In recognition of their services to

humanity the National Association for the Study and Prevention of Tuberculosis elected two physicians, who were especially active in the campaign for the eradication of the white plague, to honorary membership; these were Dr. Edward L. Trudeau and Surgeon-General Sternberg. Both men richly deserved this special honor for their labor of love, and by a



singular coincidence both men passed away in the month of November, 1915, to receive their reward beyond the grave.

STARMONT SANATORIUM

As chairman of the committee on prevention of tuberculosis of the Associated Charities, General Sternberg assisted Mr. William H. Baldwin and Dr. Kober in securing legislation for registration of cases of tuberculosis in the District of Columbia,

and in efforts to secure the erection of a tuberculosis hospital for indigent patients. Pending the erection of such an institution, he urged and established dispensaries for tuberculosis patients and secured temporary provisions for their care and treatment at the Washington Asylum Hospital. After the completion of the city hospital for tuberculosis, there were ample provisions for sanatorium treatment within the reach of the poor, but there were no facilities for the large middle class. General Sternberg set about to correct this condition by the establishment of the Starmont Sanatorium. After a tremendous personal campaign, with the aid of professional and personal friends, the Washington Sanatorium Company was incorporated in January, 1906, for the open air treatment of all forms of tuberculosis.

The sanatorium was located in Montgomery County, Maryland, 18 miles from Washington, on the Baltimore and Ohio R. R. It was beautifully situated on a high point of ground over 500 feet above sea level, and consisted of seventy-six acres of ground, improved by a commodious new house, which was surrounded by fine large trees. The building was used as an administration building and consisted of sitting rooms, dining rooms, kitchen, office and laboratory, and bed rooms for the resident physician, housekeeper and servants. The patients lived in the open, rested on an extensive porch around the main building and slept in tents. These latter were of a new design and were ventilated through the top; they were well floored and furnished, and very comfortable and attractive. Later, when the tents became weatherbeaten and worn, cottages were substituted. The stock of the company was subscribed by philanthropic citizens and physicians of Washington. All patients were required to pay moderate charges to make the institution self-supporting. While the sanatorium could not receive patients at reduced rates, many of the cases admitted were assisted by charitable organizations and individuals, by churches and by the Starmont Auxiliary. A considerable number of the patients were assisted through the liberality of Mr. Henry Phipps, who at the outset of the undertaking sent General Sternberg a sum of money to be used at his discretion for the benefit of deserving persons.

One of the greatest blessings to the sanatorium was the Samuel Berliner Infirmary, a memorial erected by his son, Mr. Emile Berliner of Washington, D. C. Mr. Berliner was much interested in the campaign against tuberculosis, and he cooperated with General Sternberg in educating the public to guard against the spread of the dread disease. He edited and issued a series of health rules for schoolchildren, distributed instructions to mothers in regard to the danger of bovine tuberculosis and advocated pasteurization of the milk supply.

When experience was beginning to tell that the sanatorium was not receiving adequate support from patients for whose benefit it was especially founded, General Sternberg issued a special appeal, calling attention to the opinion of the highest authorities on tuberculosis, that it was no longer necessary to send patients to distant localities in order to promote their recovery. Excellent results could be obtained in properly conducted sanatoriums located in the vicinity of our Eastern cities, as had been demonstrated in Massachusetts, Rhode Island, New York, Pennsylvania, Maryland, and by the experience gained at Starmont. This campaign had little or no effect on the profession, for patients of means were still urged to avail themselves of the climatic advantages of the Far West. The fact that a beautifully situated and well kept sanatorium was nearby, one that was superior in many respects to other institutions of its kind, made no impression, and most of the patients who could have assisted the sanatorium financially went to distant resorts, while the majority of those who remained were themselves in need of assistance. In spite of all efforts to offset this by benevolent contributions, it became necessary to close the doors of Starmont.

THE PRESIDENT'S HOMES COMMISSION

In spite of his varied and extensive knowledge of sociologic conditions in New York and elsewhere, President Roosevelt up to 1902 evidently had no personal knowledge of the wretched abodes hidden away in the alleys of Washington. The slums of the national capital presented a sad picture of the poverty and depravity, avarice and inhumanity which had been encountered and described by philanthropist and moralist as early as 1871. This state of affairs had been repeatedly

remarked on in preceding years, and the press had given publicity to the efforts of General Sternberg and others to correct existing evils. Mr. Jacob Riis had made a personal inspection of the situation and declared that "he had not expected to find in our national capital the peculiar, inhabited, hidden alleys, which he had noted and condemned in the notorious Whitechapel District of East London, and that the insanitary dwellings, in some respects, were worse than any he had seen in New York City." Similar opinions had been expressed by competent and conservative observers years before, but were repelled by the flippant statement that "Washington has no slums or serious tenement problems." In the fall of 1902, the President delegated Mr. Weller, general secretary of the Associated Charities, to study the social conditions and needs of the national capital, and was naturally "surprised and shocked at some accounts of 'How the other half live,' almost within the shadow of the capitol dome."

As a result of this survey of the municipal problems of Washington and other cities, the President in his message to Congress, December, 1904, dwelt wisely on the fundamental principles underlying social righteousness and civic ideals, as shown in the following extracts:

In pursuing the set plan to make the city of Washington an example to other American municipalities, several points should be kept in mind by the legislators. In the first place, the people of this country should clearly understand that no amount of industrial prosperity, and above all no leadership in international industrial competition can in any way atone for the sapping of the vitality of those, who are usually spoken of as the working classes. The farmers, the mechanics, the skilled and unskilled laborers, the small storekeepers, make up the bulk of the population of the country, and upon their well-being, generation after generation, the well-being of the country and race depends. Rapid development in wealth and industrial leadership is a good thing, but only if it goes hand in hand with improvement and not deterioration, physical and moral. The overcrowding of cities and the draining of country districts are unhealthy and even dangerous symptoms in modern life. . . .

The death rate statistics show a terrible increase in mortality, and especially in infant mortality, in overcrowded tenements. The poorest families in tenement houses live in one room and it appears that in these one room tenements the average death

rate for a number of given cities at home and abroad is about twice what it is in a two-room tenement, four times what it is in a three-room tenement, and eight times what it is in a tenement consisting of four rooms or over. These figures vary somewhat for different cities, but they approximate in each city those given above, and in all cases the increase of mortality, and especially of infant mortality, with the decrease in the number of rooms used by the family and with the consequent overcrowding is startling. The slum exacts a heavy total of death from those who dwell therein, and this is the case not merely in the great crowded slums of high buildings in New York and Chicago, but in the alley slums of Washington. In Washington people cannot afford to ignore the harm that this causes. No Christian and civilized community can afford to show a happy-go-lucky lack of concern for the youth of today, for if so, the community will have to pay a terrible penalty of financial burden and social degradation in the tomorrow. . . .

Several considerations suggest the need of a systematic investigation into and improvement of housing conditions in Washington. The hidden residential alleys are breeding grounds of vice and disease, and should be opened into minor streets. For a number of years influential citizens have joined with the District commissioners in the vain endeavor to secure laws permitting the condemnation of insanitary dwellings. The local death rates, especially from preventable diseases, are so unduly high as to suggest that the excellent wholesomeness of Washington's better sections is offset by bad conditions in her poorer neighborhoods. A special "Commission on Housing and Health Conditions in the National Capital" would not only bring about the reformation of existing evils, but would also formulate an appropriate building code to protect the city from mammoth brick tenements and other evils, which threaten to develop here, as they have in other cities. That the nation's capital should be made a model for other municipalities is an idea which appeals to all patriotic citizens everywhere, and such a special commission might map out and organize the city's future development in lines of civic and social service, just as Major L'Enfant and the recent park commission planned the arrangement of her streets and parks. . . .

In his message to the Fifty-Ninth Congress in December, 1905, Mr. Roosevelt again urged that Washington be made a model city in all respects—parks, public playgrounds, housing, education, truancy and charitable work. In the same year he commissioned his friend, Hon. James B. Reynolds, former

head worker of the University Settlement, New York, to make a survey of all federal and district departments of the government related to the general welfare of Washington.

The report of Mr. James B. Reynolds disclosed the following facts: The building laws and ordinances were defective and incomplete. One ordinance stipulated that each sleeping room should measure at least 400 cubic feet for every occupant over 10 years of age, but failed to place limitations on the number of children under 10 years who might sleep in such rooms. Hallways of tenements must be lighted at night, but no such requirement applied to necessary lighting of dark halls during the day. Nearly all wooden shacks and brick houses in populated alleys were in a very unsanitary condition, with inadequate water supply and filthy methods of sewage disposal. The worst conditions prevailed in inside alleys, which, uncontrolled by police inspection and unaffected by public observation, were centers of disorder and crime.

To correct these social defects, Mr. Reynolds recommended the appointment of a special commission to be known as the President's Homes Commission, and suggested the following plans:

1. The President's Homes Commission should be composed of fifteen members, to include among others a real estate dealer, a practical builder and two representatives of trade unions.

2. The commission should be instructed to ascertain and consider the results of the best efforts of public enterprise and private philanthropy to improve the homes and better the lives of the industrial classes in other cities in the country.

3. It should be instructed to invite cooperation of all having interest in the housing problem and the home problem in the District, and before presenting its final report it should give public hearings on the main points of its program so that all just criticism may be heard.

4. It should be advised to recommend as far as possible reforms which may be accomplished by your executive order or by the action of the District government.

5. The commission should serve without compensation and all expenses incurred should be borne by voluntary contributions.

The President designated the membership of the commission in the following letter:

THE WHITE HOUSE
Washington

May 4, 1907.

I enclose you a copy of the report made to me by Mr. James Bronson Reynolds. In pursuance of the recommendations therein made, I have decided to designate a commission of fifteen persons, as follows:

Gen. George M. Sternberg, Dr. George M. Kober, Mr. William H. Baldwin, Mr. Frederic L. Siddons, Prof. George W. Cook, Mr. Whitfield McKinlay, Miss Mabel T. Boardman, Mrs. Arnold Hague, Mr. James Bronson Reynolds, Mr. S. W. Woodward, Mr. John B. Sleman, Jr., Mr. T. C. Parsons, Mr. Emmett L. Adams, Mr. P. J. Brennan, Mr. William F. Downey.

Can you serve as a member of this commission for the purpose indicated? I earnestly hope that you can accept, as it seems to me that this commission has before it a large field of usefulness.

Yours sincerely,

THEODORE ROOSEVELT.

At the first meeting of the commission, General Sternberg was unanimously elected chairman, and the work was carefully apportioned to various committees. After a thorough study of conditions, a preliminary report was submitted to President Roosevelt, who authorized its publication in July, 1907. The full report¹ was presented in December, 1908, and contained, among other valuable features, a pioneer study of industrial hygiene.

INTERNATIONAL CONGRESS ON TUBERCULOSIS

The sixth International Congress on Tuberculosis was held in Washington, in 1908, in response to an invitation by the delegates of the National Association for the Study and Prevention of Tuberculosis at the Paris congress of 1905. At the annual meeting of the national convention in May, 1906, a plan of organization had been recommended by the directors and adopted. Dr. Lawrence F. Flick was made chairman, with power to choose and appoint other members of the committee to the number of 100, which committee was afterward known as the central committee.

In all the arrangements for the congress, General Sternberg showed a remarkable interest, and gladly rendered every ser-

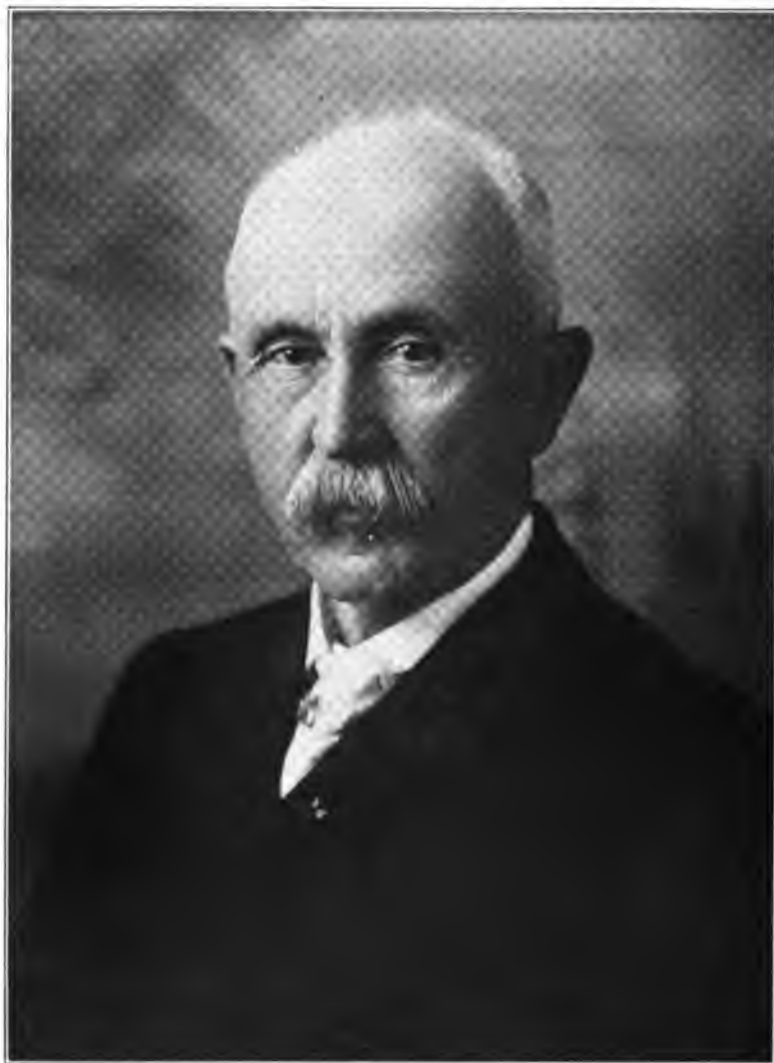
1. U. S. Senate, Document No. 644, 1909.

vice that would in any way promote the success of the movement. He was appointed the chairman of the committee on local affairs, and he entered on the work in his usual energetic manner, being at all times in close touch with the chairman of the central committee of the congress. In addition to this, he was vice president of the section on the social, industrial and economic aspects of tuberculosis. The unfinished condition of the building in which the congress was held necessitated much fatiguing effort on the part of members of the local committee. General Sternberg's physical strength was severely taxed by climbing long flights of stairs, and his heart, never strong since his attack of yellow fever, was thereby further weakened.

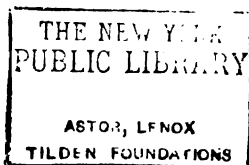
During the meeting we gave a dinner in honor of Dr. Robert Koch, discoverer of the bacillus of tuberculosis and the central figure of the congress. It will be recalled that General Sternberg had known him for many years, and he selected to meet him, men who had manifested special interest in the study and prevention of tuberculosis. The guests assembled at the dinner were Dr. Robert Koch, Prof. Panwitz of Berlin, Dr. Theodore Williams of London, Dr. Edward L. Trudeau, Dr. William H. Welch, Dr. Abraham Jacobi, Prof. Calmette, Dr. Vincent Y. Bowditch, Dr. George M. Kober, Dr. Frederic Montezambert, Dr. Louis Landouzy, Sir Arthur Newsholme (British Local Government Board), Dr. Lawrence F. Flick and Mr. William H. Baldwin.

It was on this festive occasion that Professor Koch, in response to a toast, placed his hand on General Sternberg's shoulder, saying, "Here is my brother in the work and one whom I admire among the men of the world," and on behalf of his foreign friends he complimented General Sternberg on his scientific attainments and proclaimed him the father of American bacteriology.

While penning these lines, I cannot refrain from placing on record that at the outset of the present war, General Sternberg (whose ancestors had come to this country as early as 1713 in search of liberty) felt humiliated and indignant at the nation which had produced such men as Robert Koch and other leaders in the field of preventive medicine, for its disregard of international law, and especially for the violation of Belgian neutrality. It is needless to add that a man, whose sympathies



GEORGE MILLER STERNBERG, 1912.



were at all times with the weak and oppressed, had he lived to see the day, would have hailed with delight the entry of our beloved country into the war for liberty and justice.

The last great congress attended by General Sternberg was the fifteenth International Congress on Hygiene and Demography, held in Washington, D. C., from Sept. 16 to Oct. 5, 1912. General Sternberg, as a member of the executive committee on organization and of the committee on arrangements aided in every possible way in the development and success of its instructive exhibits of hygienic topics. This meeting was held in consequence of an invitation extended by the United States Government at the fourteenth congress in Berlin, and it was attended by sanitarians and scientists from all parts of the world, with many of whom General Sternberg was personally acquainted.

CHAPTER NINETEEN

LAST CONTRIBUTIONS TO PREVENTIVE MEDICINE

After his retirement, General Sternberg had often been tempted to write the medical history of the Spanish-American War. He felt, however, that the task would be too great a tax on his strength, and he was forced, therefore, to content himself with the publication of isolated papers and addresses bearing on the subject. In December, 1912, these writings were collected in a little volume for distribution among his friends as a souvenir. Among other papers, this volume contained his reply, previously unpublished, to Col. Theodore Roosevelt's article, "The War Department." There was also reprinted an exhaustive paper on the "Sanitary Problems Connected with the Construction of the Isthmian Canal,"¹ in which General Sternberg clearly pointed out how the enormous loss of life which had attended previous unsuccessful attempts could be avoided. He recommended that "the sanitary service on the line of the Isthmian Canal should be under one head, and that the carrying out of measures for the prevention of disease and the care of the sick should be placed in the hands of a competent medical director." Attention was directed to the fact that the problem was essentially the same as that which was involved in the campaign for the eradication of yellow fever in Havana, and in this connection, he cited the work of General (then Major) William C. Gorgas, who was subsequently appointed chief sanitary officer of the Panama Canal.

SANITARY PROBLEMS OF THE ISTHMIAN CANAL

After professing his faith in the ability of the United States to surmount the engineering and financial obstacles, General Sternberg launched into discussion of the hygienic phases of the enterprise.

I have not the data at hand to enable me to state how many laborers and officials lost their lives during the progress of the work on the Panama Canal, but it is generally known that the

1. North American Review, September, 1902.

number was enormous, and that the insanitary conditions along the line of the canal, and the consequent sickness and mortality among the employees of the Canal Company, constituted one of the most serious difficulties with which this company had to contend.

The object of the present paper is to indicate how these difficulties may be avoided in future, and to impress upon those who will have charge of the work the fact that, in the present state of sanitary science, it would not only be costly, but criminal, to repeat the experiences of the past in this regard. From a humanitarian point of view, it will readily be conceded that an unnecessary sacrifice of the lives of those who are employed to do the work of excavating the canal, would be unjustifiable; but it is not to be expected that an undertaking of this kind will be postponed or delayed on account of the possibility that large numbers of human lives may be sacrificed in carrying out plans which have been made by expert engineers, and approved by the Congress of the United States.

The laborers and those who superintend their work will be very much in the position of soldiers who are sent to a distant and unhealthy country to promote the interests of their Government. They go without question or complaint; and if they fall victims to some infectious disease or to the bullet of the enemy, their places are promptly filled by others who willingly submit themselves to the same chances. But it is evident that, aside from the humanitarian point of view, the better they are trained for the service required of them—whether soldiers or laborers—the more difficult it will be to replace them, and the greater the financial loss when they are prevented by sickness from performing the special duties required of them. A Jamaica negro who is employed simply to handle a pick or a shovel, may be easily replaced; but when an engineer who has charge of a steam shovel falls sick, the expensive apparatus which he has been trained to control may lie idle.

As great engineering enterprises now depend largely upon the employment of skilled labor, it is evident that the preservation of the health of these laborers is an economic question of prime importance. From our point of view, it is so important that it is incumbent upon the government which undertakes to construct an isthmian canal to give to those who will be engaged in the actual prosecution of the work all the advantages to be derived from a well-organized sanitary service, based upon the present state of scientific information relating to the cause and prevention of those infectious diseases which are most likely to prevail under the conditions which will exist along the line of the proposed canal. We know what these diseases are; we know the conditions which lead to their epidemic prevalence; and we know how to prevent them.

Under these circumstances, it would indeed be criminal not to apply this knowledge in a practical way for the preservation of the lives of those who are called upon to battle with those malign agents which appear to oppose themselves to man, in his efforts to overcome the barriers raised by nature to arrest his progress in the subjection of the earth to his material uses. In this battle the soldier of labor is supported by enormous and complicated engines of war, operated by steam, by electricity, or by explosives which rend the solid rock.

But when these are in position and the tearing down of a mountain has been fairly commenced, all his efforts may be paralyzed, and his steam shovels and diamond drills compelled to remain idle, because of the attacks of an unseen foe, such as the bacillus of typhoid fever, the parasite of malarial fever, or the unrecognized germ of yellow fever.

The laborers upon the isthmian canal will be exposed to the ravages of all these infectious diseases; and it may be confidently asserted that each one of them will claim numerous victims, unless the proper measures of protection are enforced. It is well known that the prevalence of typhoid fever depends to a large extent upon the quality of the water supply, and that, when there is any possibility that this may be contaminated, the simple and obvious method of prevention is to sterilize all drinking-water. This is best accomplished by heat; but it is not sufficient to give directions that all water used for drinking must be boiled. There must be some one to see that a sufficient supply of sterilized water, properly cooled, is always available, and that none other is used. We cannot depend upon precept alone, when it is a question of protecting soldiers or laborers from the invisible foes which surround them. They are accustomed to judging of the purity of water by its taste and appearance, and to drinking any water at hand when they are thirsty.

The conditions under which laborers must live, while engaged in the work of excavating an isthmian canal, are in many respects similar to those under which our soldiers were assembled in camps of instruction during the Spanish-American war, with the added dangers due to a tropical environment. If questions relating to water supply and sewerage are postponed until after the laborers are assembled in the localities where the work is to be done, defilement of the camp site and contamination of the local water supplies will almost certainly occur. The ignorance and recklessness with reference to sanitary matters of the average soldier, sailor and laborer have been demonstrated by sad experience; and the inexorable laws of nature will inevitably cause the same disastrous results in the future as in the past unless we take advantage of the light shed by science upon the cause and prevention of those fatal

epidemic diseases which during past centuries have scourged the human race. To ignore the teachings of sanitary science, at the outset of the twentieth century, would be both criminal and disgraceful. In tropical and semi-tropical regions, neglect of sanitary police and contamination of the water supply are the common causes of other infectious maladies which may even exceed typhoid fever in the numbers of their victims. Among these we may mention especially tropical dysentery, chronic diarrhea, and the disorders due to various intestinal parasites. This whole group of diseases may be avoided if no food or drink is taken which contains the germs or ova which give rise to them.

But how about the so-called "climatic diseases"? Can these be avoided? Certainly they can; for, as a matter of fact, no infectious diseases are directly due to climatic influences, although climate has much to do with the prevalence of some of these diseases when the germs to which they are due are introduced to a given locality. Thus malarial fever and yellow fever prevail only where climatic conditions are favorable for the propagation of the species of mosquitoes by which the parasites to which these diseases are due are transmitted from man to man. Mosquitoes cannot multiply unless they can find water in which to deposit their eggs, and in which their larvae can thrive. They lose their activity and soon die when exposed to a temperature below the freezing point. Therefore, malarial fever and yellow fever are diseases of tropical and semi-tropical regions, or of the summer months in the temperate zone; and they do not prevail in elevated and arid regions, even in the tropics.

I shall not attempt in this paper to present the evidence which justifies the assertion that malarial fever and yellow fever are contracted through "bites" of mosquitoes. The scientific demonstration that this is a fact is complete, and is accepted by well-informed physicians in all parts of the world. This knowledge has been gained so recently, however, that the public, generally, and many men of science whose studies have been in other fields of investigation, are not fully convinced that their preconceived notions with reference to the etiology of these diseases are wrong. I may say to these persons, in brief, that we know the malarial parasite, which differs somewhat in different types of malarial fever, as well as the ornithologist knows his birds, or the farmer different kinds of grain which he sows. We know the different stages of its development in man and in the bodies of infected mosquitoes; we recognize it in the blood of patients, and unhesitatingly found our diagnosis upon the result of a microscopical examination of such blood. Finally, it has been proved that persons

may remain indefinitely in the most intensely malarious regions, such as the Roman Campagna, without contracting malarial fever, if they are protected from the bites of mosquitoes by gauze mosquito-netting. The climate of itself is not only harmless, but salubrious. We may safely say the same of the climate of the Isthmus of Panama. If we can protect the laborers on the isthmian canal from the bites of mosquitoes, they will enjoy an entire immunity from the deadly infectious maladies which have been the scourge of the coast regions of the Caribbean Sea, the Gulf of Mexico, and the West Indies for centuries.

But how is this to be accomplished? A man cannot work under a mosquito bar. No; but he can sleep under one, and he should be compelled to do so when his health is a matter of prime importance to his employer. It has long been known that "exposure to the night air" in malarious regions is especially dangerous, and now we know the reason. Mosquitoes seek their food mostly at night; and man, when not protected by a mosquito bar, is especially exposed to their attacks while he is asleep. That sleeping under a mosquito bar affords a certain amount of protection from attacks of malarial fever, has been repeatedly reported by travelers in tropical regions, but the explanation of this alleged fact is of recent date.

We have recent evidence that a properly conducted war upon the mosquito, and especially upon its breeding places, may lead to notable results in diminishing the numbers of the pestiferous insect. Witness the success obtained by Major Gorgas, Surgeon, U. S. A., during the summer of 1901, in restricting the prevalence of yellow fever in Havana, by making war upon the mosquito, which has been proved by Major Reed and his associates to be the active agent in transmitting this disease from man to man. As another instance of what may be accomplished by intelligent efforts and a reasonable amount of money, I call attention to the work done by Mr. Henry Clay Weeks on Centre Island and its vicinity.

It has long been known that excavating the soil in so-called "malarious regions" is very likely to be followed by a serious outbreak of malarial fever, or sometimes of yellow fever. This we can now understand. Such excavations lead to the formation of pools of rain-water, which afford the best possible breeding places for mosquitoes. As pointed out by Mr. Weeks, the two principal methods of fighting mosquitoes out-of-doors consist in drainage and the use of petroleum. All pools of standing water are to be done away with by drainage, if possible. If not, the surface is to be covered by a film of petroleum, which quickly destroys the larvae of the mosquito when they come to the surface to breathe. What has been undertaken in a small way on Centre Island should be carried out,

with all the energy and resources that money and competent supervision can command, along the line of the isthmian canal. Let us remember that we are undertaking this great work at the beginning of the twentieth century, and that the means of preserving the health of those employed are as important for the success of the enterprise as the perfection of the steam ploughs and diamond-pointed drills which will be used.

In the army, we have a well-trained medical corps, every member of which realizes that the preservation of the health of our soldiers is a more important matter, even, than the treatment of the sick and wounded. To aid in this work, we have a body of trained enlisted men—the Hospital Corps—equal to about four per cent. of the enlisted strength of the army. The army of laborers which will be sent to the isthmus will require a sanitary corps having a personnel at least as great in proportion to the number employed as is provided for our army in the Philippines. At the head of this sanitary service, we should have a man fully informed as to the sanitary problems which are to be encountered and the best methods of meeting them, and also of demonstrated executive ability. Under him should be sanitary engineers, expert sanitary inspectors, and a corps of intelligent men employed especially for the sanitary service. He should be given the necessary money and autocratic power for the execution of sanitary measures for the protection of the health of the employees engaged in the construction of the canal. He should also have general direction of the medical service, including the establishment of hospitals at properly located points, the purchase of medical supplies, etc. He should select the medical staff for service at these hospitals and at the various camps or stations where the work is in progress. The physicians at these stations should be required to make frequent inspections of the employees, for the purpose of placing upon sick-report or in hospital any man who has fever or dysentery, or any other symptom indicating that he is unfit to work. Rest, suitable diet, and proper medication will often restore such person to perfect health in a short time. But if left to their own devices, soldiers and laborers often fail to report for treatment in the early stages of a serious malady, when treatment would be most efficacious, and not only endanger their own chances of recovery, but, in the case of certain infectious diseases, place their comrades in danger.

It is in this way that epidemics often have their origin. Mild and unrecognized cases of typhoid fever, of yellow fever, or of cholera are more dangerous, from a sanitary point of view, than severe and fatal cases which are promptly recog-

nized and properly cared for. Careful sanitary supervision is therefore essential; it is, moreover, economical in the interest of the canal and of the government which has undertaken to construct it, as well as of those who are engaged in the actual work of excavation.

In the army, for military reasons, the medical department is not given any direct authority for the execution of sanitary measures outside of the general and post hospitals, which are under the direct command of medical officers. The commanding officer of a camp or of a military post is responsible for the execution of necessary measures which may be recommended by the Surgeon-General of the army, or by the surgeon of his command, or which may be required by army regulations and general orders from the War Department. In carrying out these sanitary measures the medical department has only an advisory function. An officer of the line, or of the engineer corps, or of the Quartermaster's department, is detailed, with enlisted men or civilian employees to assist him, to dig the sewer, or lay the water pipes, or drain the swamp, etc.; and the general sanitary police of the post or camp is maintained by a detail of enlisted men, or by a squad of general prisoners under the direction of a "police sergeant," or in some cases by civilian employees engaged for this special service. Whether this method is best for the army has been seriously questioned; and it is contended by some medical officers that better results would be obtained if more authority were given to the medical officers, and they were made responsible for the carrying out of necessary sanitary measures, and not simply for making suitable recommendations. However this may be, there can be no question that the sanitary service on the line of the isthmian canal should be under one head, and that the carrying out of measures for the prevention of disease and the care of the sick should be placed in the hands of a competent "medical director," having an efficient staff and full power to act in accordance with his best judgment for the accomplishment of the desired results.

The cost of such a sanitary service would not be inconsiderable, but it would not be great when considered in connection with the magnitude and importance of the work; and I do not hesitate to affirm that, from an economic point of view, such a sanitary service as I have indicated would greatly reduce the cost of constructing the canal, and would shorten the time required for its completion.

A single epidemic of yellow fever occurring among the employees along the line of the canal, at a time when the work was being actively prosecuted, would, without doubt, be more expensive than the cost of an efficient sanitary service during the entire period of construction.

HISTORY OF THE YELLOW FEVER BOARD

Spurred on by the advice of his intimate friends and stimulated by the promised attendance of some of his scientific co-workers from Latin America, General Sternberg summarized, for presentation before the Pan-American Scientific Congress in 1915, the "Researches Relating to the Etiology of Yellow Fever Which Culminated in the Findings of the Reed Board."

It is generally recognized that the demonstration that yellow fever is transmitted by mosquitoes of the genus *Stegomyia* is one of the greatest achievements of modern sciences. And the credit for this demonstration is justly given to the commission of which Maj. Walter Reed, Surgeon, U. S. Army, was president, which was sent to Havana in 1900, on the recommendation of the writer, then Surgeon-General of the Army.

Doctor Carlos Finlay of Havana had long before conceived the idea that the disease under consideration is transmitted by mosquitoes, and full credit should be given him for persistently advocating this theory, although his own experiments failed to furnish any satisfactory proof that his theory was well founded. Indeed, such proof was wanting in the earlier experiments of the Reed Board, and it was not until, as a final experiment, the mosquitoes, after filling themselves with blood from a yellow fever patient, were kept for ten or twelve days before allowing them to bite a susceptible individual, that success was attained.

In a report published in May, 1901, Major Reed says: "We have thus far succeeded in conveying yellow fever to twelve individuals by means of the bites of contaminated mosquitoes." Confirmation of these results was soon after afforded by the experiments of Dr. Juan Guiteras, and today yellow fever prophylaxis is successfully based on this epochmaking discovery.

But as to the precise nature of the etiologic agent, or "germ," we are still uncertain, although in the present state of science we can scarcely fail to believe in a living germ, which multiplies in the blood of infected individuals, but which is so minute that it has not yet been demonstrated by the highest powers of the microscope.

1. This historical résumé was prepared a few weeks before the lamented death of General Sternberg, and is an important contribution to the history of that momentous period. All of which the writer knew and a large part of which he was. John Van R. Hoff, M.D. (Colonel, U. S. Army, Retired).

I have no new facts to add to our knowledge of yellow fever etiology. But it has occurred to me that a brief account of the investigations which led up to the demonstration that yellow fever is transmitted by mosquitoes might be of some interest to the members of the Pan American Scientific Congress. Such an account must begin with the Havana Yellow Fever Commission of 1879.

The wide extent and great mortality of the yellow fever epidemic of 1878 led to the organization of a U. S. National Board of Health. And it was evidently expected that one of the most important duties of this board would be to attempt to devise methods for the prevention of similar epidemics.

Among the members of this National Board of Health was Dr. S. M. Bemis of New Orleans, who no doubt had much to do with the selection of the members of the commission which it was decided should be sent to Havana to study the disease in one of its principal endemic foci. The membership of this commission was as follows: President, Dr. Stanford E. Chaillé, New Orleans, Secretary, Surgeon George M. Sternberg, U. S. Army; Dr. Juan Guiteras, U. S. Marine Hospital Service, and Mr. T. S. Hardee, a civil engineer of New Orleans. Mr. Rudolph Matas of New Orleans was appointed clerk to the commission, and Mr. Henry Mancel, a Frenchman living in New Orleans, was engaged as photographer.

In the division of our work it was decided that Dr. Chaillé should make investigations relating to the prevalence of yellow fever in the island of Cuba. This he did in a most comprehensive manner, as is shown by his published report to the National Board of Health. Doctor Guiteras undertook the search for micro-organisms and for pathologic changes in the tissues of yellow fever cadavers. This he did, *secundum artem*, but his painstaking labors did not throw any new light on the etiology of the disease. To me was assigned the examination of the blood, culture experiments, and experiments on lower animals. It would be tedious to attempt to give details of my numerous experiments and observations, but I may say that I failed to find any micro-organisms in the blood of living patients drawn on different days of sickness and did not succeed in producing any symptoms resembling yellow fever in the lower animals subjected to experiment.

I may say that in advance of my visit to Havana I had strong hopes that, by modern methods of research, the germ of this infectious disease might be found in the blood, and I was prepared to photograph it if found. I was provided with Zeiss 1/12 and 1/18 inch homogeneous oil immersion objectives and I had received instructions in the art of making photomicrographs from Surgeon J. J. Woodward, U. S. Army, a pioneer



Havana Yellow Fever Commission, 1879.

1. Dr. George M. Sternberg. 2. Dr. Juan Guiteras. 3. Dr. Daniel M. Burgess.
4. Dr. Stanford E. Chaillé. 5. Mr. A. H. Taylor. 6. Dr. Rudolph Matas.

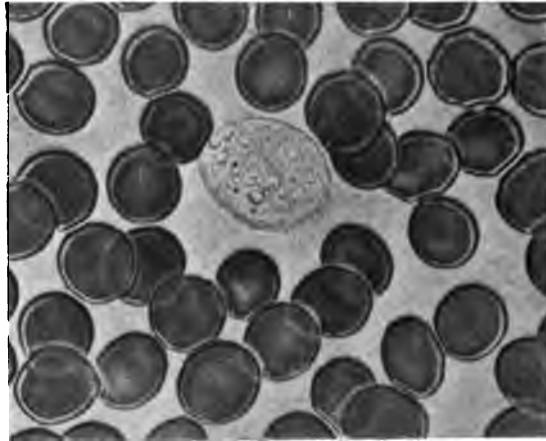


Figure 1



Figure 4



Figure 3



Figure 5

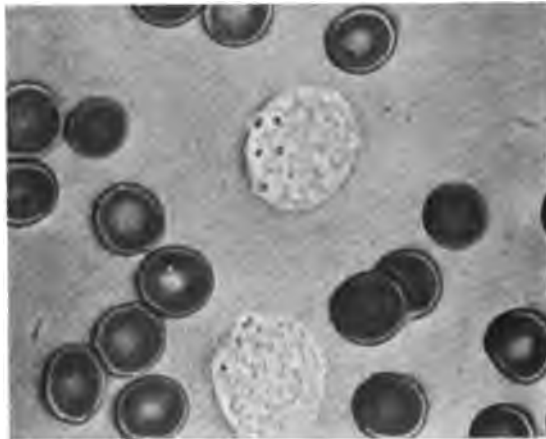


Figure 2

Fig. 1.—Yellow fever blood; fifth day; fatal case. $\times 1,450$.

Fig. 2.—Yellow fever blood; first day; fatal case. $\times 1,450$.

Fig. 3.—Yellow fever blood; fifth day; fatal case. $\times 1,450$.

Fig. 4.—Leukocyte in yellow fever blood kept in a culture cell for two days, eighth day; fatal case. $\times 650$.

Fig. 5.—Leukocyte in yellow fever blood kept in culture cell for two days; eighth day; fatal case (same as Fig. 3). $\times 650$.

and recognized expert in the art at the Army Medical Museum. Ninety-eight specimens from forty-one undoubted cases of yellow fever were carefully studied, with a completely negative result, so far as micro-organisms were concerned. My photomicrographs were mostly made with a magnifying power of 1,450 diameters, obtained by the use of a Zeiss 1/18 inch objective and a Tolles amplifier.

I have a reproduction of a plate illustrating my report on the etiology and prevention of yellow fever, published in 1890. These photographs of yellow fever blood were made in Havana in 1879. The report embodies the researches made by me subsequent to the return of the yellow fever commission. In it I say:

"The investigations to which this report relates were made in the city of Havana, in the summers of 1888 and 1889; in the city of Decatur, Ala., in the autumn of 1888; and in the laboratories of the Johns Hopkins University, where I have continued my researches during the intervals between my visits to the infected localities, and since my return from Havana, in September, 1889, up to the present date."

"My bacteriologic studies have been made with material obtained from forty-three yellow fever cadavers; from 'black vomit' and feces of patients in various stages of the disease; and from comparison, from eighteen cadavers in which death occurred from some other disease than yellow fever, and from feces of healthy individuals."

After the extended researches in this report I state my conclusions as follows:

"The experimental data recorded in this report show that:

The specific infectious agent in yellow fever has not been demonstrated.

The most approved bacteriologic methods fail to demonstrate the constant presence of any particular micro-organisms in the blood and tissues of yellow fever cadavers.

The micro-organisms which are sometimes obtained in cultures from the blood and tissues are present in comparatively small numbers, and the one most frequently found (*Bacterium coli commune*) is present in the intestines of healthy individuals, and consequently its occasional presence can not have any etiologic import.

A few scattered bacilli are present in the liver and probably in other organs, at the moment of death. This is shown by preserving portions of liver, obtained at recent autopsy, in an antiseptic wrapping.

At the end of from twenty-four to forty-eight hours the interior of a piece of liver so preserved contains a large number of bacilli of various species, the most abundant being those

heretofore mentioned as occasionally found in fresh liver tissue, viz., *Bacterium coli commune* and *Bacillus cadaveris*."

"Having failed to demonstrate the presence of a specific "germ" in the blood and tissues it seemed possible that it is to be found in the alimentary canal, as is the case in cholera. But the extended researches made and recorded in the present report show that the contents of the intestines of yellow fever cases contain a great variety of bacilli and not a nearly pure culture of a single species, as is the case in recent and typical cases of cholera."

"On the other hand nonliquefying bacilli are very abundant.

The one most constantly and abundantly present is the *Bacterium coli commune* of Escherich.

This is associated with various other bacilli, some of which are strict anaerobics and some facultative anaerobics.

Among the facultative anaerobics is one—my *Bacillus X*—which has been isolated by the culture method in a considerable number of cases and may have been present in all. This bacillus has not been encountered in the comparative experiments made. It is very pathogenic for rabbits when injected into the cavity of the abdomen.

It is possible that this bacillus is concerned in the etiology of yellow fever, but no satisfactory evidence that this is the case has been obtained by experiments on the lower animals, and it has not been found in such numbers as to warrant the inference that it is the veritable infectious agent.

All other micro-organisms obtained in pure cultures from yellow fever cadavers appear to be excluded, either by having been identified with known species, or by having been found in comparative researches made outside of the area of yellow fever prevalence, or by the fact that they have been found only in small numbers and in a limited number of cases."

It will be seen that I did not positively exclude my *Bacillus X* as a possible etiologic factor, but I say that it was not found "in such numbers as to warrant the inference that it is the veritable infectious agent." In 1893 I was appointed Surgeon-General of the Army, and my opportunities for personal research work ceased. My published reports had apparently satisfied the profession that the various claims which had been made for the discovery of the specific germ of yellow fever had no substantial foundation. Among these were the claims of Domingos Freire of Brazil, of Carmona y Valle of Mexico, of Carlos Finlay¹ of Havana, and of Paul Gibier of France.

Since my report above referred to was published a new claimant appeared, viz., the Italian bacteriologist, Sanarelli. His researches were made in Brazil, and, singularly enough,

1. His micrococcus tetragenus febris flavae.

he found in the blood of the first case examined by him a bacillus. It was present in large numbers, but this case is unique, for neither Sanarelli nor anyone else has since found it in such abundance. It has been found in small numbers in the blood and tissues of yellow fever cadavers in a certain number of cases examined. For a time I thought it probable that Sanarelli's bacillus was identical with my *Bacillus X*. But the researches of the Reed board identified it with the bacillus of hog cholera, while my *Bacillus X* appeared to them to belong to the colon group. The bacillus of Sanarelli had a certain amount of standing for a time because two medical officers of the U. S. Marine Hospital Service, who had been sent to Havana to study yellow fever, made a report favorable to the claims of Sanarelli. But the researches of Reed, Carroll and Agramonte have demonstrated conclusively that this bacillus has nothing to do with the etiology of yellow fever.

At the present date Dr. Aristides Agramonte is the only living member of the Yellow Fever Commission appointed upon my recommendation in 1900. Major Walter Reed, Surgeon U. S. Army, was selected as president of this commission because he was a trained bacteriologist and at the time of his appointment was in charge of our bacteriologic laboratory at the Army Medical Museum. He died in Washington from appendicitis, Nov. 23, 1902, aged 51. Since his death various articles published in the newspapers have stated that he died as a result of his yellow fever investigations. This is a mistake. Dr. Reed was in Washington at the time that Dr. Carroll made, on himself, the first successful yellow fever inoculation, and he was not inoculated.

Dr. James Carroll died in Washington, March 9, 1907, of myocarditis which was believed by his physicians to have resulted from the severe attack of yellow fever which he suffered in 1900. Dr. Jesse W. Lazear, Contract Surgeon, U. S. Army, was appointed a member of the commission because he had had special training as a bacteriologist. He died at Camp Columbia, Cuba, of yellow fever, Sept. 25, 1900. His attack was attributed to the bite of a mosquito, while he was visiting the wards of a yellow fever hospital.

The written instructions given by me to this selected board of experts were as follows:

"You will naturally give special attention to questions relating to the etiology and prevention of yellow fever. As you are familiar with what has already been done by other bacteriologists in this field of investigation, I do not consider it necessary to give you any suggestions or detailed instructions. But it is evident that the most important question which will occupy your attention is that which relates to the etiology of this disease.

You will also take advantage of such opportunities as may offer for the study of other infectious diseases, and especially of the malarial fevers prevailing on the island of Cuba. An important question in connection with the disease of tropical and semitropical countries relates to the etiology of febrile attacks of short duration, to which strangers are especially subject. Should you have time, there will be ample opportunity for the study of leprosy in the lepers' hospital in the city of Havana. Attention should also be given to the infectious diseases of the lower animals, in case any such prevail, the etiology of which has not been definitely determined."

In addition to these written instructions I talked freely with Major Reed, president of the Commission, and gave him my views as to the most promising lines of experiments relating to the etiology of yellow fever.

I urged that efforts should be made to ascertain definitely whether the disease can be communicated from man to man by blood inoculations. Evidently if this is the case the blood must contain the living infectious agent on which the propagation of the disease depends, notwithstanding the fact that all attempts to demonstrate the presence of such a germ in the blood, by means of the microscope and culture methods, had proved unavailing. I had previously demonstrated by repeated experiments that inoculations of yellow fever blood into lower animals—dogs, rabbits, guinea-pigs—give a negative result, but this negative result might be because these animals were not susceptible to the disease and could not be accepted as showing that the germ of yellow fever was not present in the blood. A single inoculation experiment on man had been made in my presence, in the city of Vera Cruz, in 1887, by Dr. Daniel Ruiz, who was in charge of the civil hospital in that city. But this experiment was inconclusive for the reason that the patient from whom the blood was obtained was in the eighth day of the disease, and it was quite possible that the specific germ might have been present at an earlier period and that after a certain number of days the natural resources of the body are sufficient to effect its destruction, or in some way to cause its disappearance from the circulation.

I was especially anxious that this experiment should be repeated with the blood taken from a case in the early stages of the disease. I had not been able to make the experiment on myself, as I was immune, having suffered a severe attack of yellow fever in 1875.

The Reed Commission made this experiment with success after having demonstrated that the disease could be transmitted by mosquitoes which had been kept for ten or twelve days after biting a yellow fever patient. It is evident that if the

experiment had been made at the outset of the investigation a similar success would have led inevitably to the conclusion that yellow fever, like malarial fever, is transmitted by an intermediate host, and that this intermediate host is a mosquito.

So far as I am concerned, there is nothing more to be said about yellow fever etiology, and my excuse for writing this brief paper is to be found in the fact that the present generation of physicians had not appeared on the stage when Professor Chaillé, Dr. Juan Guiteras and myself visited Havana in 1879, for the purpose of studying yellow fever, and probably few of the members of the profession have seen my published report of subsequent investigations made by me.

The following letter is here introduced as especially interesting in connection with Dr. Sternberg's research in yellow fever.

April 13, 1915.

My dear General Sternberg:—

A group of kindred spirits were discussing the eminent workers in American science the other evening and we all agreed not only in placing you among the foremost, but the first pioneer. It may also be some satisfaction for you to know that in our judgment Dame Fortune played you scurvy tricks, for the same amount of skill and energy devoted to plague, cholera, typhoid fever or any of the ordinary bacterial infections would have solved these riddles. However, in attacking the cause of yellow fever, you originated many methods which were afterwards used with success, and furthermore, cleared away the brush, or rather you blazed the trail which made it so much easier for those who followed. . . .

Very truly yours,

M. J. ROSENAU.

CHAPTER TWENTY

GENERAL STERNBERG'S DEATH

Although General Sternberg had been in delicate health for several years, his interest in civic and philanthropic activities remained unabated. He rarely missed a board meeting and he continued to render active service as president of the housing companies, the Association for the Prevention of Tuberculosis and of several hospital boards up to within ten days of his death. Peacefully and quietly in the early morning hours, November 3, 1915, came the end, that end which despite anticipation or expectation was felt as a shock through a wide circle of friends and admirers.

MEMOIRS OF GENERAL STERNBERG

General Sternberg's character and personality may be best evaluated by the estimate of his associates. On his seventieth birthday (June 8, 1908), a host of official and personal friends had presented a loving cup as a token of their esteem, and on this occasion, touching tributes were paid to him.

STERNBERG THE MEDICAL OFFICER

Maj. Walter D. McCaw, M.C., U. S. Army, taking as his theme General Sternberg's character as a medical officer, said:

It is always a pleasant thing to speak good of others; it is said to be a highly laudable thing to do so even when there is little to be said, and much to be covered by the mantle of charity; but it is a delight to honor a good man in the presence of his fellows, when his hair has whitened in the service of his country, when his whole life presents a continuous record of duty well done, of original work and discovery for the benefit of others, of some distinct addition made to the sum total of human happiness.

Our honored guest of tonight is well known to all here as a scientist, as a philanthropist, as a broad-minded citizen; he is also, of course, known to you as the Surgeon-General of the Army for over nine years, but I doubt if all here know what a splendid medical officer he was before he had made a name in science, before he had reached the chair of the Surgeon-General.

His first appearance in military life was dramatic enough—at the first battle of Bull Run, where, before he had become warm in his new uniform, he met his first military difficulty

and characteristically overcame it—in other words, he was captured by the enemy and promptly escaped. We may follow him after this through the four years of the war, in the field, in the great hospitals and on several expeditions.

After the war he went West—young medical officers of the Army generally did go West and stayed there too—and here he soon met more dangerous foes than the veteran soldiers of the South, for he went through one terrible epidemic of cholera and later while serving South, two epidemics of yellow fever. He finished the youthful and we may say the fighting part of his service by an Indian campaign, where he received a brevet for gallantry in performing his duties under fire. Not yet forty years old—but already a record to be proud of.

Knowing what we do of the life of the Army on the frontier years ago, we may be very sure that many things occurred in the life of our guest fully as worthy of our admiration as these bare facts which the record shows. Our small regular army has never received from our people the credit due for its long and patient work in helping to build up the civilization of the great West. The army has never been a band of idlers, fattening upon the treasury and waiting for wars that never came. There has never been a time that the army was not actually doing something for the people. The fringe of the civilization of the West grew steadily forward under the shadow of line upon line of little military stations. The plains and hills, where the Indian sounded his war whoop and the coyote ranged at will, are now covered by farms and pastures, by cottages and mansions with a sturdy and prosperous people. When one goes West now for the first time in a palace car and sees the stars and stripes floating over many a schoolhouse he can form no idea of the long and perilous journeys of former days, by stage coach, by wagon train or on horseback, and the comfort that the same flag brought when it was sighted above the little camp or cantonment. Under the protection of the forts grew up humble villages and scattered ranches, dwellings built of mud, of sod or rough-hewn timber. The army fought for these people when occasion offered (and there was seldom a time when there was not fighting somewhere between the Canadian and Mexican borders), but it made life possible for the settlers in many other ways, and the lonesome post surgeons did their part manfully. I know our guest could tell us of many a weary mile ridden on errands of mercy, of many a medical and surgical victory won unaided and alone, of many a native son or daughter of the golden West laid in the mother's arms.

At the close of his Western service and following his second yellow fever experience, the scientific trend of General Sternberg's mind began to show itself in his writings.

From now on, for a long period of years, the government employed him to make many researches in the domain of hygiene and sanitation, and to investigate epidemics, so that his name soon came to stand high among those who knew. Especially in the new and growing science of bacteriology did he achieve honor. Just as he had entered the military service with the first battle of the war, so did he do pioneer work as a bacteriologist.

While the immortal Pasteur was at the height of his activity, while Koch was building up his great reputation, while Lister was applying the new science to rob the surgeon's knife of its terrors, General Sternberg was working and discovering, becoming first among the bacteriologists of America.

Finally, after thirty-two years of service, when he had seen battle and pestilence, when he had sat with the wisest as their peer, he was called to fill the highest position in the medical department of the army. He had given it the years of his young manhood, he had given it the best work of his maturer life, and now he was to inspire and direct.

His administration was marked by the growth of the new science that had revolutionized medicine and surgery among the medical officers of his corps, and as many and as great as have been General Sternberg's services to the army, I believe his greatest was that he always fostered and directly inculcated a scientific spirit in his corps. Every one who was willing to work received from him encouragement. All could get means of self-improvement—books, instruments and material.

A second great gift, which will be a monument to him, was the establishment of the Army Medical School, which is now considered so indispensable, that graduation thereat is made requisite to obtaining a commission in the medical corps.

When General Sternberg, after more than forty years' service, laid down his pen and vacated his chair at the War Department, he could look back upon a life of action and accomplishment that might have satisfied anyone. He could then have taken his ease as he chose without fear of criticism, but it is characteristic of the man that relaxation and amusement offered no attractions to him. That he remained and that he still is a scientist, a worker, a fighter in the first rank against disease and poverty is well known.

Others better qualified than I will now tell you of the parts he has played as scientist, as philanthropist, and as citizen—under them all will be found the character of the physician and the soldier. To quote the words inscribed on the commission that every army officer possesses, underlying all will be found the "patriotism, the valor, the fidelity and abilities" of Sternberg, the medical officer.

STERNBERG THE SCIENTIST AND AUTHOR

Dr. George M. Kober, an intimate associate of General Sternberg during the greater part of his active career, spoke of his attainments as a scientist and author:

It is a remarkable fact worth emphasizing, that a man of Dr. Sternberg's scientific bent of mind should have seen more active service on the battlefield and in Indian campaigns than any other medical officer with whose record I am familiar. His heroic deeds and brilliant services to the army have been recounted, and it remains for me to speak of his battles with the invisible foes in infectious diseases, which, after all, are more destructive than bullets. It requires no less amount of courage to handle day after day disease germs, than to face the enemy on the field of battle. To have been one of the pioneers in bacteriology is a distinction of which any man may be justly proud, and when this distinction has fallen in America to the lot of our friend and fellow citizen, we may be sure that in honoring him we honor ourselves.

I do not know of a single medical officer who has faced cholera and yellow fever epidemics as often and courageously as our distinguished guest. During the cholera epidemic at Fort Harker, Kansas, in 1867, he lost a beloved wife, and by a strange coincidence he was also the post surgeon when yellow fever gained a foothold among the troops at Fort Columbus, New York, in 1871. Having witnessed the devastating effects of these hydra-headed diseases and realizing that medical science had not yet discovered the real cause of these scourges which had carried off countless victims and paralyzed the commerce of seaport and inland towns, both at home and abroad, it is perfectly natural that a man of Dr. Sternberg's sympathetic nature and truly scientific spirit should have determined to devote his life to the study of these mysteries.

As a result of his experience and efficient service at Governor's Island, he was ordered to the yellow fever zone in 1872, and served at New Orleans and Fort Barrancas, Florida, where his wife courageously accompanied him. At Barrancas he witnessed two epidemics of yellow fever in 1873 and 1875; and during the latter epidemic he himself suffered a severe attack. His first publication of scientific value related to the clinical history of yellow fever as observed by him during these outbreaks. In 1876 he was ordered to the Pacific coast, and in the following year he was engaged in an active Indian campaign against the Nez Percés Indians, where he distinguished himself for gallant service in performance of his professional duty under fire at the battle of Clearwater, Idaho, July 12, 1877, for which he received the brevet of lieutenant-colonel. It was my good fortune to meet our guest for

the first time upon my return from the same campaign, in the fall of 1877, at a frontier post, Walla Walla, where he, in addition to his official duties, mastered the French language. In 1878, while stationed at the same post, he began his experiments to determine the practical value of disinfectants, using putrefactive bacteria as the test of germicidal activity. These experiments were subsequently continued in Washington, D. C., and in the laboratories of the Johns Hopkins University, under the auspices of the American Public Health Association, as chairman of a committee appointed and given an appropriation for the purpose of making such investigations. The results of these investigations were published in full in the Transactions of the American Public Health Association in 1888, but had won for him the "Lomb prize" as early as 1886. This prize essay, published in 1886, and revised by Dr. Sternberg in 1899, has been translated into several foreign languages, and practical measures of disinfection in this country and abroad are largely based upon the results obtained in these investigations. It may be truly said that scientific disinfection had its inception with the labors of Koch and Sternberg. Formerly certain physical and chemical agents were empirically used. Now we know that they are effective because they destroy the vitality of the germ.

No one unless familiar with bacteriological work can have the slightest conception of the magnitude and painstaking labors involved in the determination of the "thermal death point of pathogenic organisms and the germicidal value of certain chemical and physical agents." It meant daily and exacting application extending over a period of years, but it was glorious work in the battle against infectious diseases. The eradication of preventable diseases is the highest aim of scientific medicine today, and in this field Dr. Sternberg was one of the foundation builders. You will ask with Prince, now King Edward, "If certain diseases are preventable, why are they not prevented?" My answer is, that while every scientific physician familiar with biologic research knows full well, that if the methods of prevention recommended by Sternberg and his school, including the prompt disinfection of the dejecta of every typhoid fever patient, the expectoration and excretions of diphtheria and tuberculosis patients, for example, were adopted, these diseases would be reduced to a minimum and probably eradicated in the course of a few years. The facts are, these recommendations have not been generally adopted, because the knowledge gained by experimental research is not sufficiently diffused, even among physicians.

Had it been otherwise, the lessons of the Civil War and the note of warning sounded by Surgeon-General Sternberg, in his famous circular of April 25, 1898, four days after the decla-

ration of the Spanish-American War, would have made a deeper impression upon the volunteer medical officers, and the disgraceful unsanitary scenes of our military camps would not have been observed.

Notwithstanding these disadvantages we are already reaping the benefits of his beneficent work. It is certainly glorious to know that the average span of life since 1880 has been lengthened fully six years, and that the mortality rate in the United States has been reduced from 19.6 in 1890 to 16.2 per thousand in 1905, which means a saving of over 290,000 lives in one year alone, the greatest decrease having been accomplished in the so-called preventable diseases.

Dr. Sternberg's labors were not limited to this special field, for in the interval we find him active in other research work. In 1880 he discovered the micrococcus now recognized as the specific cause of croupous pneumonia and demonstrated the fact that it is found as a saprophyte in the buccal secretions of the mouths of perfectly healthy individuals. Later (1885) he demonstrated the fact that the micrococcus of sputum septicemia—his *Micrococcus Pasteuri*—is identical with the capsulated micrococcus found in the rusty sputum of patients with croupous pneumonia. While it has fallen to the lot of Fränkel to share the credit of this important discovery, there can be no question that Dr. Sternberg first recognized and described the organism, although he did not associate it in his first publication with pneumonia, as he found it in his own and the buccal secretions of other healthy subjects. His work on sputum septicemia also for the first time explained the virulent character assumed in many instances by the bites of human beings.

Dr. Sternberg was also the first to point out the rôle which the leukocytes or white corpuscles of the blood play as defenders of the living body against the invasion by pathogenic bacteria. In one of his publications, in 1881, he suggested that the disappearance of the bacteria from the circulation in the experiments referred to, "may be effected by the white corpuscles, which it is well known pick up after the manner of amebae, any particles, organic or inorganic, which come in their way and it requires no great stretch of credulity to believe that like an ameba, they may digest and assimilate the protoplasm of the captured bacterium, thus putting an end to the possibility of its doing any harm."

This explanation is now very commonly spoken of as the "Metschnikoff theory," although as shown by the above quotations, it was clearly stated by Dr. Sternberg several years (1881) before Metschnikoff's first paper (1884) was published. Metschnikoff has, however, been the principal defender of this explanation of acquired immunity, and has made exten-

sive and painstaking researches, as a result of which many facts have been brought to light which appear to give support to this theory.

In 1881, while stationed at Fort Mason, Calif., he demonstrated and photographed probably for the first time in America the tubercle bacillus, which had been discovered by Koch in 1881.

In the same year he demonstrated that the so-called *Bacillus malariae* of Klebs and Tommasi Crudelli was not an etiological factor in the production of malaria, which served to concentrate attention upon Laveran's plasmodium discovered in 1880, and it was finally proved by the work of Manson and Ross that the mosquito was the intermediate host of the malarial parasite. It was also Dr. Sternberg's good fortune, in 1885, upon his return from the International Sanitary Conference in Rome, to demonstrate for the first time in this country the plasmodium of Laveran in freshly drawn blood from a malarial patient. This demonstration was made in the pathological laboratory of the Johns Hopkins University and the ameboid movements of the plasmodium in the interior of the red blood corpuscles were plainly visible.

In 1886 he introduced the bacillus of typhoid fever to the medical profession in this country, in a paper read before the Association of American Physicians.

Dr. Sternberg's investigations with reference to the etiology of yellow fever date back to 1871, although his search for the specific organism commenced in Havana, in 1879, while a member of the Havana Yellow Fever Commission, and was continued for about ten years. During this time he twice returned to Havana during the months of yellow fever prevalence and visited Rio de Janeiro and Vera Cruz, also the town of Decatur, Ala., during the epidemic of 1888. His report, published at the conclusion of these extended investigations, shows that all researches made to that date had failed to demonstrate the specific cause of yellow fever. He showed that the generally accepted claims of Domingos Freire, of Brazil, to have discovered the germ of this disease—his *Cryptococcus xanthogenicus*—and a method of producing immunity by inoculations had no scientific foundation. He also showed that the bacillus of Gibier, the "micrococcus tetragenus" of Finlay, and various micro-organisms encountered by himself and by other investigators bore no etiological relation to the disease. At the International Medical Congress, held at Berlin in August, 1890, I translated Dr. Sternberg's letter to Professor Hirsch, giving a synopsis of his work and stating that so far the specific organism of yellow fever had not been discovered. It certainly speaks well for his painstaking work that even now, when we know that the infectious agent is transmitted

through the sting of a mosquito, and the search has narrowed down to the body of this insect, it has not been isolated, and neither he nor others have found it, probably because it is ultramicroscopic.

Having exhausted the resources at his command in his search for the germ of yellow fever by microscopical examination of the blood and tissues, by culture methods and by experiments on the lower animals, he felt that the only method left which offered any promise of success was that of direct experiment on man. If the blood of a yellow fever patient contained the specific infectious agent, this should be shown by inoculating a non-immune individual with such blood.

This line of research, I am informed, was pointed out by Surgeon-General Sternberg to Major Walter Reed, chairman of the Yellow Fever Commission in 1900, as was also the probability that it would ultimately be found that the disease is transmitted from man to man by an intermediate host.

In justice to all concerned, it should be remembered that when this commission was organized by General Sternberg, the claim of the distinguished bacteriologist Sanarelli to have demonstrated the etiological relation of his "*bacillus icteroides*" was generally accepted, and had been recently confirmed by two medical officers of the Public Health and Marine Hospital Service sent to Cuba for the special purpose of investigating this claim. To General Sternberg it appeared impossible that a bacillus, which is easily demonstrated under the microscope and which grows in ordinary culture media, could have escaped his observation during his extended researches, if it were in fact the specific cause of yellow fever. The only possibility of such causal connection seemed to him to depend upon the identification of Sanarelli's bacillus as identical with a certain bacillus found by Sternberg in a limited number of cases during his researches in Havana. A comparison of cultures of the two micro-organisms made by Major Reed at the Army Medical Museum, 1899-1900, showed that they were not identical and General Sternberg, being satisfied that Sanarelli's bacillus was not concerned in the etiology of yellow fever, organized in 1900 the Yellow Fever Commission, with Major Reed as chairman. Major Reed's investigation resulted in the demonstration that in yellow fever the specific infectious agent is present in the blood of those suffering from the disease and that the usual and probably the only method of transmission of the disease is through the bites of mosquitoes of the genus *Stegomyia*. This brilliant demonstration by Reed and his colleagues has furnished the necessary basis for preventive measures which have been applied with entire success in the yellow fever zone, and the practical results are of incalculable value to mankind.

I do not consider it unfair to the memory of Major Reed and his colleagues when I declare that much of the success achieved was rendered possible by the preliminary work of Dr. Sternberg, who had eliminated numerous errors committed by others and had contested and overthrown the claims of several bacteriologists for the discovery of the specific organism. His conviction that all former claims, even the mosquito theory first suggested by Nott and Finlay were unfounded or remained to be proven, is clearly evinced by the appointment of a commission, which he personally selected. I have purposely devoted much time to the presentation of his research work, not to detract in the slightest degree from the brilliant achievements of my departed friends, but in the interest of truth and justice.

In giving due credit to all the participants of this splendid piece of research, it must be remembered that Dr. Sternberg's work was of the highest scientific value, and his daily contact with the sick, his autopsies and bacteriological investigations in different countries and climes in search of the yellow fever germ involved at least the same risks and heroism displayed by members of the Yellow Fever Commission. Hence, I do not hesitate to say, that no history of this important discovery is complete without a just presentation of Sternberg's preliminary work which led up to the appointment of the commission, and I prefer to make this statement while one of the members of the commission, Dr. Agramonte, and our honored guest are still alive.

Dr. Sternberg was the pioneer in this country, not only in bacteriological investigations, but in the publication of bacteriological textbooks. In 1880, he translated the work of Dr. Antoine Magnin from the French. In 1884 this work was greatly enlarged and brought up to date (480 pp., 8vo., including 152 pp. from Magnin's work).

In 1892 Sternberg's *Manual of Bacteriology* was published (898 pp., royal 8vo., illustrated by numerous photographs and cuts). In 1896 this work was revised and published under the title of a *Text-Book of Bacteriology*.

Dr. Sternberg since 1880 has been in the habit of illustrating his published works and scientific papers by photomicrographs made by himself. He has shown himself a master in this difficult art, and in 1884 published a volume on photomicrographs and how to make them (204 pp., 8vo.). Other published works of Sternberg are *Malaria and Malarial Diseases* (329 pp., 8vo., Wm. Wood & Co., New York); *Immunity, Protective Inoculations in Infectious Diseases and Serum Therapy* (325 pp., Wm. Wood & Co., New York, 1895); *Infection and Immunity, with Special Reference to the Prevention of Infectious Diseases* (293 pp., Putnam's Sons, 1903), making in all

2,592 pages, not to mention his chapters in textbooks and medical encyclopedias and over sixty other contributions to medical and scientific literature, many of which have been translated into foreign languages.

General Sternberg's brilliant services to the nation have never been adequately rewarded, but Dr. Sternburg's unceasing study, honesty and truth have gained him admission into the temple of fame. Brown University and the University of Michigan have conferred the degree of Doctor of Laws, seven societies and academies, both at home and abroad, have enrolled his name as an honorary member, three national scientific associations have chosen him as leader, which position he also occupied in the Biological and Philosophical societies and the Cosmos Club of this city. . . .

STERNBERG THE PHILANTHROPIST

Hon. David J. Brewer, Justice of the United States Supreme Court, recounted General Sternberg's works of philanthropy:

Reference has been made to his distinguished career in the army. He not only rose to the highest position in the medical department, but by his studies and investigations added largely to its great reputation. When he had reached the age at which the Government holds that an officer has filled out the full measure of his service to the nation, and had retired him therefrom, instead of dropping to a life of ease and idleness, as so many do, he entered upon a new career of exceeding usefulness and blessing to the community.

Let me mention some of the activities in which he has been engaged since the Government said he had become too old to serve it. You may have been in the slums of New York or other large cities, and been shocked with the pitiable sights. Mere shacks or tenements for homes, with little of sunlight or fresh air, with dirt and filth abounding, vice and crime showing their hideous faces, and crowded with old and young, ignorant of cleanliness, without ambition or hope, and presenting only miserable pictures of the possible wretchedness of life. Who that has seen them has not longed for something to sweep away this great volume of ignorance, filth and vice, and trusted that nothing like it would be found in the city in which he dwelt. While Washington has never been so afflicted as some cities, yet we had our slums and General Sternberg became a leader in our deliverance therefrom. He organized a housing company, which has already erected two hundred houses, with two apartments in each house, filled with pure air and sunlight, with all sanitary accommodations and under a supervision which insures decency and cleanliness in every home. And as these houses were all speedily occupied, in

order to reach a class which could not afford even the small rent charged for them, he organized a second housing company, which has already put up forty houses, with two apartments in each, smaller, cheaper, and yet clean, with sanitary conveniences, and where fresh air and sunlight abound. Surely Washington owes much to him who has secured for four hundred and eighty families comfortable, decent, clean homes, places in which old and young are surrounded by the conveniences of life and in which the children will grow up with some idea of the better things of life.

But this is not all. He has been for years the president of the Citizen's Relief Society, that association which, working with the Associated Charities, provides funds for the relief of the poor and dependent, and at the same time strives to secure for each an opportunity for work and a chance to earn a living and to open the prospect of a life of usefulness and respectability. Knowing as I do a little of the great work in which these associations are engaged, I feel that he has been in this one of the real benefactors of this city.

But still again, his active spirit of humanity was not content with these labors. That terrible disease which has carried off so many lives and which we popularly know as the white plague was present everywhere. It appealed to him to do what was possible to stay its ravages. Whoever has, as I have done, stood beside the bedside of a dear one, and seen that dear one grow thinner and thinner, paler and paler, as she wasted away, until at last the end came and her "pale and sacred clay" was borne away to rest in that which in ancient Saxon phrase is called God's Acre, can but look with thankfulness upon one, a master of the science of medicine, who gives his time and toil and skill to ward off that disease. Within twenty miles of this city he has established a sanitarium or camp, whichever it may be called, where from twenty to thirty tuberculosis patients are cared for, and all that science has discovered in the way of checking the disease is applied.

Surely, notwithstanding all the honor which attaches to his distinguished service as medical director of the Army, I feel that his last days and his last work spent in these humanities have been his best days and his best work. He has shown that he knows the religion of the humanities. He has read the story of the Good Samaritan. He has caught the inspiration of those words of the Master, "inasmuch as ye have done it unto one of the least of these my brethren, ye have done it unto me." While my friends Rabbi Stern and Simon Wolf may not believe in the Nazarene as I do, I am sure that they endorse the blessedness of the work which General Sternberg has done. Whether he be orthodox in theology I do not know,

but I do know that he has been orthodox in devotion to the humanities and the blessed work of making life on this earth better and sweeter. . . .

At a joint memorial meeting of the Medical Society of the District of Columbia and the Association for the Prevention of Tuberculosis held January 19, 1916, Dr. S. S. Adams referred to General Sternberg's efforts for the suppression of tuberculosis in these words:

Only those who had been closely associated with General Sternberg in the local organizations for the prevention of tuberculosis could realize fully the tremendous impetus and sustaining power contributed by his personality: he was undismayed alike by the magnitude of the task and by public indifference to the needs of the work.

At a similar meeting,¹ Col. Edward L. Munson, M.C., U. S. Army, said:

It is with a mingled sense of melancholy pleasure that the writer undertakes a brief summary of the broad achievements, useful service and sterling worth of General Sternberg, for it was his duty to serve as a member of the official family of the latter during the trying period following the cessation of hostilities with Spain and including the Philippine insurrection.

As a chief in war time, the great abilities of General Sternberg were to be respected. He inherited conditions for which he was in nowise responsible, and which higher authority, though appealed to, would not furnish the means of preventing. That General Sternberg appreciated in advance most of the faults and difficulties encountered in the Spanish War is personally known to the writer from long and confidential association. He did all that the means afforded which were provided him.

As a scientist, he, in his long career, brought great fame to the Medical Corps. He embodied its scientific ideals, and he brought many of these ideals to accomplishment. He was a large contributor to medical science, the library of the Surgeon-General's Office having on file no less than 142 separate books and articles from his pen. Very many of these were based on his own work, and represented notable additions to the advance of medical and scientific progress of the time. He was a pioneer, who blazed the trail into many new fields of thought where others followed.

1. Thirteenth Annual Meeting of the American Society of Tropical Medicine, Washington, D. C., May 9, 10, 11, 1916.

Of clean and lofty purpose, kindly nature and almost womanly sympathy; he was a true friend. The writer will always hold the personal association with General Sternberg, which he enjoyed, in grateful remembrance. In his sense of fairness and even justice, his standards were the highest. He played no favorites. He leaned backwards in his effort not to be influenced by personal preference. When it came to official business, he had neither friend to reward nor enemies to punish. A square deal, an equal chance for all, a further opportunity for those who took advantage of those already given them—this was his code.

Dr. A. C. Abbott, one of the foremost bacteriologists of America, read the following memorial note before the College of Physicians of Philadelphia, April 5, 1916:

I am highly honored by your invitation to present a minute on the death of our late fellow, George Miller Sternberg, Surgeon-General of the United States Army, retired. In the death of General Sternberg we note the passing of one of America's most active pioneers in modern preventive medicine. He was certainly the first American to be conspicuously identified with the science of bacteriology and to recognize its bearings upon the problems of epidemiology and prevention. His most important investigations were made at a time long antedating the advent of the methods of Koch now invariably employed in bacteriological research; methods that are today the common property of every medical student graduated from our reputable schools. It was my happy privilege to have been associated with Dr. Sternberg in the fall and winter of 1884-1885—when his rank was that of major. He was then holding, by courtesy, a Fellowship in the Johns Hopkins University. It was through his influence and kindly interest that my attention was drawn to the problems of public hygiene, and I am grateful for this opportunity to record my deep indebtedness to him. Only those intimately associated with Dr. Sternberg can appreciate his singular individuality—a tireless worker, unsatisfied with anything less than the best; convinced only by arguments emanating from experimental data and always with an eye to the application of results to the welfare of mankind. Busy at all times, but never hurried, his affairs were in such order that confusion was unknown; modest, kindly, generous and patient, it was a privilege and delight to receive the benefit of his council.

General Sternberg was born at Hartwick Seminary, Otsego Co., N. Y., on June 8, 1838. He died at his residence in Washington, D. C., on November 3, 1915, at the age of seventy-

seven years. He was a descendant of one of the German families from the Palatinate that early settled New York State. He spent his boyhood days and received his preliminary education at Hartwick Seminary where, for a time, his father was the principal, and his grandfather, on the maternal side, was a professor. At the age of sixteen he was a self-supporting school teacher. He began the study of medicine at the age of nineteen under the preceptorship of Dr. Horace Lathrop of Cooperstown, N. Y., and was graduated as Doctor of Medicine from the College of Physicians and Surgeons with the class of 1860. He practised medicine for a time at Elizabeth, N. J.

With the outbreak of the Civil War, he decided to enter the army, and in 1861, after due examination, was appointed Assistant Surgeon of the United States Army. He was in active service throughout the war. He was present at the first battle of Bull Run, and at the engagements at Gaines' Mills, Turkey Ridge, and Malvern Hill. He received brevet commission for meritorious services during the war and later the brevet commission of Lieutenant-Colonel for "gallant service in the performance of his professional duties under fire in action against the Indians at Clearwater, Idaho, in 1877."

In an exhaustive notice of General Sternberg's scientific and military career, his friend, Dr. Kober, of Washington, remarks: "Dr. Sternberg has seen more active service on the battlefield and in Indian campaigns than any other medical officer with whose record we are familiar."

But it is not alone on the battlefield that Dr. Sternberg exhibited his fidelity to duty. He was medical officer at Fort Harker, Kansas, in 1867, during an epidemic of Asiatic cholera, and was post surgeon during an outbreak of yellow fever among the troops at Fort Columbus, N. Y., in 1871. It is probable that impressions made by the ravages of those diseases had much to do with deciding Dr. Sternberg in the course that his subsequent medical activities were to take. The valuable experiences gained in his study of the yellow fever outbreak at Fort Columbus resulted in his being detailed in 1872 for service at New Orleans, La., and Fort Barrancas, Florida—both in the so-called yellow-fever zone. At the Florida post he passed through two epidemics, in the second of which he himself contracted a severe attack of the disease.

The first of Dr. Sternberg's scientific publications was a clinical description of yellow fever as witnessed by him in the several epidemics through which he had passed. In 1878, while post surgeon at Fort Walla Walla, on the Pacific slope, he began investigations upon the value of commercial disinfectants—a line of work with which his name was conspicuously identified until the question was finally and satisfactorily settled. His experiments, begun at an army post, were continued

in Washington, D. C., and at the Johns Hopkins University, where the importance of his researches led to his being awarded a "Fellowship by courtesy." He was at that time of the rank of Major, detailed for post duty at Baltimore. The expenses incidental to so costly an investigation were borne by the American Public Health Association of which he was at one time president, and for years an active and influential member. The results of his investigations upon disinfectants won for him the "Lomb Prize" in 1886. The honor of having placed the whole question of disinfection on a scientific basis belongs conjointly to Sternberg and Koch. It was during his fundamental investigations upon the value of commercial disinfectants, made under a grant from the American Public Health Association, that I became his assistant, and it was from him that I received my first instruction in bacteriology. Were it not for fear of wandering too far afield, I would relate some of my experiences while associated with this remarkable man. At the time the accurate, simple and logical methods of Koch were not available to workers in American laboratories. In fact there were no workers at all in pure bacteriology in this country, General Sternberg, to my knowledge, being the only one, and I can assure you that I appreciated my good fortune when the opportunity presented for me to serve as his assistant. Only those familiar with the exacting nature of a serious bacteriological research, conducted by the immature methods of that time, can appreciate the magnitude of his work on disinfection—and when it be made known that through all that investigation he was ably conducting the affairs of the military post to which he was detailed, one realizes to some extent the tireless energy and love of work with which he was endowed. Coincident with his studies of disinfectants were researches in other fields of bacteriology. In 1880 he discovered in the saliva a micrococcus to which he gave the name "*Micrococcus pasteurii*." As he had found it in his own saliva and in the saliva of many other normal human beings—and as he had demonstrated that its introduction into the tissues of certain animals resulted only in fatal septicemia—it is not astounding to find him surprised when Fraenkel declared pneumonia in man to be caused by an organism identical with "*Micrococcus pasteurii*," which organism is now generally known as "*pneumococcus*." The literature of the time on the subject is somewhat confusing, due in large part to the limitations of and to the differences in available technic—but nevertheless, call the organism what we may, it was Dr. Sternberg who discovered it and described many of its peculiarities, though he failed to recognize its most important activities. In 1881 he proved conclusively that the so-called "*Bacillus malariae*" of Klebs and Tommasi Crudelli, then

attracting wide-spread attention, had nothing to do with the causation of malarial fever and in 1885 demonstrated for the first time in this country the living, motile *Plasmodium malarie* first seen by Laveran in 1880, and subsequently proved to be the cause of malarial fever.

Of the many and varied problems with which Dr. Sternberg was identified, probably none absorbed more of his energies than that concerning yellow fever. It would take more time than is allowed me to follow his studies of this disease in all their ramifications. We can, however, content ourselves with saying that through his individual effort, *i. e.*, investigations made by him personally—he closed once and for all time the question as to the likelihood of yellow fever being a disease of bacterial origin. Only those who were on the spot and saw the remarkable tenacity with which he followed out to its termination every promising lead, can realize the determination of a man whose only reward for an enormous expenditure of energy was negative results. But we must not underestimate the value of such results—remember, please, that at the time of which I write almost nothing was known of yellow fever beyond its clinical manifestations, and bacteriology was hailed as the science through which the riddle was to be solved. Errors in abundance were made and had to be corrected. Dr. Sternberg did this. Having exhausted the subject so far as the available bacteriological, microscopic and inoculation methods would permit, Dr. Sternberg conceived the idea of experiments on human beings. Dr. Carlos Finlay, of Havana, had already made certain inconclusive investigations in the way of protective inoculations of man through the use of infected mosquitoes. The next step was the appointment of the U. S. Army Commission with Major Walter Reed at its head. The results of the activities of that commission in enlightening us upon the subject are too well known to require comment at this time. But the essential thing to remember is that the organization of the Yellow Fever Commission was General Sternberg's idea.

Not the least important of his many activities were those concerned with photomicrography, of which he was a master. He was the first in this country to reproduce by photography *Bacillus tuberculosis* discovered by Koch in 1882. In 1884, in his revision of his 1880 translation of Magnin's *Bacteriology*, he published a large group of photomicrographs of bacteria that were comparable in their excellence to many that have subsequently appeared, and superior to any in existence at that time. In 1892 appeared the first edition of his own book, *A Manual of Bacteriology*, and in 1896 a revision entitled a *Text-book of Bacteriology*. In addition he was the author of several other books on special topics, notably *Malaria and*

Malarial Diseases; Immunity, Protective Inoculation in Infective Diseases and Serum Therapy; Infection and Immunity, with Special Reference to the Prevention of Infectious Diseases.

He was a frequent writer of chapters for collaborative books, of articles for encyclopedias, and more than sixty special scientific papers stand to his credit.

During the time of his Surgeon-Generalship (1893 to 1902) he established the Army Medical School; established laboratories for scientific investigations at most of the important army posts; provided all new army hospitals with modern operating rooms, and encouraged their use by surgeons in the service; he established the army tuberculosis hospital at Fort Bayard, New Mexico. Immediately after the declaration of war with Spain, within four days, to be exact, he issued a circular upon camp sanitation and dwelt upon the possible rôle of flies in disseminating typhoid fever. This warning was not heeded, with results well known to all of us.

He organized the board for the investigation of typhoid fever; composed of the late Major Walter Reed, the late Dr. E. O. Shakespeare, a Fellow of this College, and Dr. Victor C. Vaughan, of the University of Michigan. Upon his recommendation Drs. Vaughan and Shakespeare were commissioned as surgeons of volunteers. As said, he organized the Yellow Fever Commission composed of Major Walter Reed, Drs. Carroll, Lazear and Agramonte. During the Spanish-American War he organized eight army hospitals at appropriate points and equipped two hospital ships and one hospital train. He organized the female nursing corps and the corps of dental surgeons in accordance with an act of Congress, passed at his suggestion, and recommended a large increase in the medical corps to correspond with the increase in the army made in 1901.

After his retirement from active service—necessitated by the age limit—he devoted his tireless energies to what he regarded as the duties of a citizen. He was affiliated in a conspicuous way with many organizations having to do with the welfare of the National Capital. He was president and founder of the Washington Sanitary Improvement Company; of the Washington Sanitary Housing Company; president of the President's Homes Commission; president of the Citizens' Relief Association; president of the Washington Sanatorium Company; director of the Starmont Sanatorium; chairman of the committee on the Prevention of Tuberculosis; member of the committee on the International Tuberculosis Congress; president of the Board of Directors of Garfield Hospital; president of Board of Visitors of St. Elizabeth's Hospital, and Professor of Preventive Medicine in George Washington

University. He held membership in many important societies. Besides being a Fellow of this College, he was a member and ex-president of the American Public Health Association; member and ex-president of the American Medical Association; member and ex-president of the Association of Military Surgeons; member and ex-president of the Philosophical Society of Washington; of the Biological Society of Washington; of the Cosmos Club; honorary member of the Association of American Physicians; of the New York Academy of Medicine; of the Epidemiological Society of London; of the Academy of Medicine of Rio de Janeiro; of the American Academy of Medicine, and of the French Society of Hygiene. The Honorary Doctorate of Laws was conferred upon him by the University of Michigan in 1894, and by Brown University in 1897.

Dr. Sternberg was what we are pleased to call a self-made man. His early environment was certainly not luxurious: a schoolteacher at sixteen; a student of medicine on borrowed money at nineteen, all of which money he subsequently earned and returned to the lender; a surgeon in the United States Army at the age of twenty-three—speaks for individual capacity that bade well to carry its possessor far in the race for preferment—as his subsequent history has well shown to have been the case.

An incident during the course of my acquaintance with him often impressed me with his will and energy. At the age of fifty-five or thereabouts he knew nothing of the German language. It was at a time when the most important of our researches were emanating from the German laboratories. He knew French intimately, but that helped only in part. Was he discouraged? Not at all. With the aid of a tutor and by close application he acquired a trustworthy reading knowledge of German in less than two years.

Though I knew General Sternberg more or less intimately from 1884 until the date of his death, I never so fully appreciated the magnitude of his attainments, his services to mankind, or his devotion to duty as I did in the course of preparation of this minute. In the death of General Sternberg, this College loses one of its most distinguished fellows, American medicine, a pioneer of whose attainments it may be justly proud, and those who knew him well, a faithful, kindly friend.

CHAPTER TWENTY-ONE

CONGRESSIONAL RECOGNITION

During the last years of General Sternberg's active service in the Army, he was on terms of intimate friendship with Senator Gallinger. Both were educated physicians, interested in medical charities and in the protection of public health. It was but natural then, that after the death of General Sternberg, Senator Gallinger should introduce a bill in the Senate granting a pension to his widow, Mrs. Martha L. Sternberg. July 19, 1916, after recognition by the presiding officer, Senator Gallinger remarked:

Mr. President, I am well aware of the fact that the Committee on Pensions, and the Congress itself, is not as liberal in the matter of the payments of pensions to the widows of general officers, as it was at the time when I had the privilege of acting as Chairman of the Committee on Pensions. However, I wish to call the attention of the Senate to the case of Mrs. Sternberg, widow of the late General Sternberg, which is so unusual, so clearly out of the ordinary, that I want to make an appeal to the Senate to increase the amount that is allowed in the bill.

General Sternberg had a most remarkable career, Mr. President. It was General Sternberg who organized the Yellow Fever Commission in 1900, which Commission, under the late Major Reed made the famous investigation resulting in the discovery that yellow fever was due to inoculation by mosquitoes, which discovery revolutionized the views that were held concerning that disease and practically obliterated it from the United States.

General Sternberg, Mr. President, as a scientific man probably held more important positions than any other man in the history of this Government. I have here a list of positions he held, with which I hope every Senator will acquaint himself if he has any objection to the motion which I am about to make. I would, if time permitted, discuss this matter at considerable length, but I have only five minutes in which to do it, and shall content myself with reading one or two letters in reference to the matter which I find in the report of the Committee on Pensions.

Mr. Tillman: "I suggest to the Senator to insert them in the Record without reading."

Mr. Gallinger: "I want to read what Dr. Gorgas—General Gorgas, as we ordinarily know him—says. I find this letter from him:

War Department,
Office of the Surgeon-General,
Washington, March 9, 1916.

Dear Mrs. STERNBERG:

My long service in the Army Medical Corps under General Sternberg has given me a very intimate knowledge of the character of his work during the long period he served his country. He began his service during the Civil War at the Battle of Manassas, on which occasion his services were most gallant and conspicuous. For many years after the Civil War he served on our Western frontier.

His scientific investigations with regard to yellow fever were extensive and useful. He had a severe attack of yellow fever at Fort Barrancas, Fla., contracted while he was post surgeon at that post in connection with his duties. When he was made Surgeon-General of the Army in 1893 he was in the forefront of bacteriologists and would have at that time ranked among the first two or three bacteriologists of the world. I think his memory deserves well of our country.

Very sincerely yours,

WM. C. GORGAS,
Surgeon-General, United States Army,

Mr. President, there is a very interesting letter here from Dr. George M. Kober, a well known scientist of this city; a remarkable letter from Ex-Senator Root in which he pays tribute to the remarkable achievements of General Sternberg; a letter from General Wood, and other testimony that is of very great importance."

Senator Gallinger thereupon moved that "\$50" be stricken out and that "\$100" be inserted in order that adequate provision might be made for the widow of an illustrious scientist and patriotic American.

Mr. JOHNSON of Maine: "Mr. President, the case of Mrs. Sternberg appeals very strongly to the Committee because of the eminent services of her husband, which the Senator from New Hampshire (Mr. Gallinger) has detailed here; but in only very few cases has Congress given a pension above \$50 a month. Fifty dollars a month is the limit which the Committee on Pensions in the House and in the Senate have established where a soldier requires the help of another person to care for him; and we have felt that in the case of Mrs. Sternberg in allowing \$50 a month, we have been very liberal. There are on the list a very few, but there are a few, who have pensions

at \$75 a month and a few who have pensions of \$100 and only a very few, as the Senator from New Hampshire knows."

Mr. SHAFROTH: "Mr. President, it seems to me that this case is upon a different basis from the one suggested by the Senator from Maine. Dr. Sternberg was a man who contributed to science a wonderful discovery that has revolutionized the treatment of one of the most terrible diseases that has ever scourged mankind. It seems to me as a tribute to that discovery, if nothing else, the amendment offered by the Senator from New Hampshire ought to be adopted."

Mr. GALLINGER: "Mr. President, if the Senator from Colorado will permit me I desire to suggest that during the last years of Dr. Sternberg's life he did remarkable service in the matter of tuberculosis, giving his time freely and contributing very largely to the knowledge of that dread disease, as well as to the knowledge of yellow fever."

The Vice President: "The question is on the amendment of the Senator from New Hampshire." (The amendment was agreed to.)

August 5, 1916, Mr. Keating of Colorado called up in the House of Representatives the conference report on pensions bills which included that for Mrs. Sternberg:

Mr. KEATING said: "Mr. Speaker, there has been a great deal of discussion concerning General Sternberg's part in the campaign which resulted in the conquest of yellow fever. Perhaps the most impressive witness we can produce at this time is Dr. Agramonte, the surviving member of the famous Sternberg Commission. In January of this year Dr. Agramonte was in this city, and he addressed the following letter to Dr. George M. Kober, a distinguished scientist and one of Washington's esteemed citizens." (See page 218).

Mr. MILLER of Minnesota: "Mr. Speaker, I would like to be recognized if I can get the time."

Mr. MANN: "The gentleman from Colorado has the time."

Mr. KEATING: "I will yield to the gentleman from Minnesota."

The Speaker: "The gentleman from Minnesota (Mr. MILLER) is recognized for ten minutes."

Mr. MILLER of Minnesota: "Mr. Speaker and gentlemen of the House, I feel justified in asking for ten minutes by reason of the very deep interest that I personally feel in the case, having known General Sternberg in his lifetime; and having during the past four or five years been pleased to make some investigations relative to the incidents of the Civil War and the subse-

quent period. I have come to feel that this particular item is extraordinary and should receive the unanimous approval of the membership of the House.

General Sternberg was one of the giant figures of this century. Modest, unassuming, gentle in manner, as greatness always is, ever at work each year of his life, ever dedicated to the public service, every atom of his wonderful brain and energy given to humanity. He never spoke of himself. His modesty precluded that but medical history and the military history of the last half century speak for him. He began his public service, if I can use that term in connection with the career of a surgeon in the Army, at the very outbreak of the Civil War. A young man with exceptional attainments and a splendid college training, he entered the Union Army as a surgeon and accompanied the Union forces to the disastrous field of Bull Run. He did not run from the field. He remained heroically and resolutely at his task. He stood on the field whence friends had fled, there where the Blue and Gray commingled lay upon the first great battle field of the Civil War, and he bound up the wounds of both alike (Applause).

He was captured, of course, by the Confederates, and for a week, night and day, he used his talent and his energy to ease the pain, to relieve the suffering, and to save the boys of the North and South. He then exhibited that daring which subsequently contributed to his great professional success. His parole expired and he made his escape from the prison camp, traveled 25 miles through the wilderness, swam the Potomac River, and the next day was ready for service here in Washington.

Years afterward he presented the same characteristic for heroism and consecration to duty in many of the great Indian campaigns of the West, such that in one—perhaps the most notable that we have had—he was recommended for conspicuous gallantry on the field under fire and advanced to brevet rank by reason of his service on that occasion. He rose to such a position in the Army medical service that Grover Cleveland, President of the United States, in 1893 made him Surgeon-General of the Army, and he immediately entered upon a reorganization of the service, its development being such that the present highly scientific spirit and splendid condition is the result. He occupied that important position for nearly ten years.

But it is not so much his direct connection with the military branch of the Government that commends this case to me as it is the long and distinguished service he rendered to humanity. In 1871 yellow fever appeared on Governor's Island in New York Harbor. At that time familiarity with yellow fever was not general in the North and Dr. Sternberg was a pioneer in

combating the yellow fever during that epidemic. His experience gained at that time was valuable to him and to his country, and he was soon thereafter regarded as an authority on the subject.

In 1873, two years later, he again met this horrible plague in the South. Never once faltering, never once wavering, he knew his danger, but he battled and he won, for the plague was checked, the land freed of the scourge and countless lives saved by isolating the people, removing them to a healthy island. But he fell a victim to the horrible fever, in the third epidemic which he had faced at Fort Barrancas, serving on his field of duty. He almost passed away, but with impaired health he was saved for future work for his country. He had been studying yellow fever intimately and closely. He continued that work for a quarter of a century, and performed those preliminary studies which narrowed the causes of yellow fever and enabled science to get a grip upon the dread disease. Here came into play his leadership in the realm of bacteriology, his trained mind, his extended experience.

During this period by scientific research he demonstrated that the generally accepted theory of the celebrated bacteriologist, Sanarelli, as to the cause of yellow fever was wrong, as were many other theories that had been advanced, and so narrowed the field of necessary investigation that his eyes were squarely upon the mosquito.

After he became Surgeon-General of the Army, with the power at his command, he organized this Yellow Fever Commission and placed at their disposal the twenty-five years of his work; and he had become known as not only the pioneer, but the greatest bacteriologist in America.

In 1880, he made one of the greatest contributions to our medical science, which was the discovery of the microorganism which is the cause of croupous pneumonia. Later on he became interested during the closing years of his life in a general organized movement throughout the country to wipe out the cause of tuberculosis. He was one of the leaders in the American society in this regard, and to his labors he contributed all of his talent and a large measure of his time.

You may be interested to know that when the great Dr. Koch, of Germany, was here a few years ago he placed his hand upon the shoulder of General Sternberg and said: "Here is my brother in the work, one whom I admire among the men of the world." Well he might have said that, because in the very year that Dr. Koch discovered the tuberculosis bacillus, General Sternberg demonstrated and photographed it.

But as to his work in the yellow fever situation it seems to me an additional word might with propriety be said. He was the pioneer, the worker, the experienced man. His experi-

ence, his knowledge, and his genius selected the men for this commission which was to do so much for the world. He gave them their directions as to their work, and, as they say, he was their inspiration.

The distinguished Dr. William H. Welch, of Johns Hopkins University, Baltimore, speaks of General Sternberg's work in the following extraordinary manner.

'I was not only intimately acquainted personally with General Sternberg, but I am familiar with the facts of his scientific and professional career and work.

The position of leadership attained by General Sternberg not only in the Medical Corps of the Army but in the medical profession of this country attested by the important offices which he held, was based upon scientific and professional achievements of the highest order which brought him national and international fame.

Dr. Sternberg was the pioneer worker in the modern science of bacteriology in this country, and to this subject he has made contributions of great importance. He discovered the germ which causes lobar pneumonia and made valuable studies relating to this organism. He greatly advanced our knowledge, both from the scientific and the practical sides of disinfectants and disinfection. He published many valuable papers concerning infection and its problems, his *Manual of Bacteriology*, which appeared in 1892, being a comprehensive and authoritative work.

General Sternberg's researches upon yellow fever, extending over a period of a quarter of a century, are of great importance and an essential part of that series of investigations which led to the discovery of the mode of conveyance of this pestilence and the method of its prevention. With great zeal, industry, and skill he applied modern bacteriological methods to the search for the germ of yellow fever and to the claims arising from time to time as to its nature. This painstaking work had to be done, and it was accomplished by General Sternberg in a manner which laid satisfactory foundations for further studies. These further studies were conducted under his administration as Surgeon-General of the Army and by the so-called Army Yellow Fever Commission appointed by him or upon his recommendation. With the work of this commission he was in constant touch, and he welcomed the epoch-making results thereby attained as crowning the laborious series of investigations upon the same subject which had occupied his attention for so many years.'

It is apparent from this bare mention of the few of the contributions of General Sternberg to medical science in the

domain of preventive medicine that he rendered important services which deserve ample recognition by the Government of his country.

The work of this Yellow Fever Commission is one of the great achievements in the world's history. The Southland is at last free from the scourge. Cuba has become a health spot. The work of that commission enabled us to build the Panama Canal. It has enabled us to clean up western South America and the Central American States, and the world is no longer subject to one of the greatest of plagues.

The men of the Yellow Fever Commission have all gone but one, these men who solved the problem, the man who organized the Commission and was its inspiring genius and guide is the last to pass away. We have recognized merit and worth as we ought to. If we do not, there is no meaning to republic, no meaning to free government, no meaning to unmeasured generous service to humanity. We appropriately have given to the widows of two of the men who were on this commission \$125 a month. One member of the commission is still living, a Cuban, Dr. Agramonte. As the gentleman from Colorado (Mr. Keating) has said, he has recently testified to the work of General Sternberg in connection with the Commission.

Had General Sternberg devoted even a portion of his lifetime to acquiring remuneration for his services, he might have died a rich man. In my humble judgment he has contributed more for the well being of humanity than almost any other man I can name in the whole realm of medical science during the last half century. It seems to me that a great—I do not mean to say generous, but I think I have a right to say a fairly considerate government will recognize the lifetime of service, the heroic devotion and the splendid achievements of this man and honor his memory, a memory that ought to be blessed and hallowed by every man in the South. He has done more for you than any other living man. I believe you agree with me that his widow, who is now in advanced years, ought to be able to live in reasonable comfort during the remaining period of her life, and the distinguished services of this noble man thereby in some degree recognized by an appreciative Government."

Other business came up, but later the conference report was agreed to.

CHAPTER TWENTY-TWO

DEDICATION OF GENERAL STERNBERG'S MONUMENT

Wednesday, Nov. 5, 1919, at 3:30 p. m., a large number of friends of General Sternberg and the student officers of the Army Medical School assembled at the Arlington National Cemetery to participate in the exercises of the unveiling of the monument erected to his memory. A number of appropriate addresses were delivered. Major-Gen. Merritte W. Ireland, Surgeon-General, U. S. Army, spoke of General Sternberg's accomplishments as Surgeon-General:

GEORGE M. STERNBERG AS SURGEON-GENERAL

We have met today to assist at the unveiling of a fitting monument to one of the most able and eminent of the Surgeon-Generals of the United States Army. In our Medical Corps, it is a matter of historical pride that each of the Surgeon-Generals has achieved something of importance in constructive administration in his day. Sternberg was one of the most remarkable of all.

Of General Sternberg's army life and of his scientific work, others will speak. Briefly, he was the pioneer bacteriologist in this country, the man who first taught American physicians how to study and photograph organisms, who, himself, discovered the germ of pneumonia before Pasteur and described it before Fränkel, and who cleared the ground and laid the foundation for Walter Reed's discovery of the mode of transmission of yellow fever.

He was Surgeon-General of the United States Army during the last decade of the nineteenth century and the beginning of the twentieth century (1893-1902). In these ten years Sternberg did more constructive work for the Medical Corps than any other preceding Surgeon-General. In his administration the Army Medical School, the dream of all the Surgeon-Generals since the Civil War, was finally established and made a going concern; the Army Nurse Corps and the Dental Corps of the Army were established by acts of Congress, and the tuberculosis hospital at Fort Bayard, N. M., was established. All these were entirely new departures in military medicine and things which have become of extraordinary moment in the terrible war which we have just gone through. General Sternberg's activities during the Spanish War were of the same creative type. He established eight general hospitals, ordered the purchase and equipment of two

hospital ships and a fully equipped hospital train, issued memorable circulars as to the danger of typhoid fever in camps, the rôle of flies in the transmission of disease and the importance of camp sanitation and its prevention. At this time the prevention of typhoid fever was an almost insoluble problem. The typhoid fever board, organized at General Sternberg's instance, consisted of Reed, Vaughan and Shakespeare, and gave us an entirely new point of view for the prevention of this disease. In connection with his own important researches in the causation of yellow fever, Sternberg organized the famous yellow-fever commission of 1900, with Major Walter Reed as chairman. This commission discovered the transmission of yellow fever by the mosquito, which, more than anything else, made the construction of the Panama Canal possible. Other innovations made by General Sternberg will always be memorable in the Medical Department of the Army. He was the first to encourage medical officers to engage in scientific research through the establishment of laboratories and appointments in all the larger post hospitals. The brilliant record already made by the Medical Corps in the science of infectious diseases is the result. Instead of discharging soldiers for disabilities, curable by surgical treatment, which might render them life pensioners on the government, he provided all new hospitals with well-equipped operating rooms and directed medical officers to operate in such cases.

These are only a few of General Sternberg's achievements. We dedicate the monument, now unveiled, to the memory of this remarkable man, whose name is writ large in the military and scientific annals of this country.

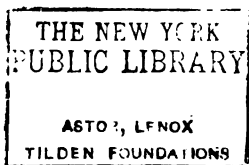
STERNBERG THE MEDICAL OFFICER

Brig.-Gen. Walter D. McCaw, M. C., U. S. Army, sketched the early career of General Sternberg as a medical officer, or in the homely phrase of frontier days, a "soldier doctor":

By our presence here today we are paying a tribute to the memory of Gen. George Miller Sternberg, which I conceive to be in a large measure personal rather than public—a tribute from some of us who knew this man as well as his work. We do not celebrate the unveiling of this monument which marks his last resting place with music and procession and long orations. The stone itself, as befits a military tomb, is inscribed with a few sentences only, but in words that are pregnant with meaning to those that understand. It may be that at some future day a public monument of some kind may be dedicated to his memory in the presence of an appreciative crowd



Monument to GEORGE MILLER STERNBERG.



of American citizens who will know the value to his country of General Sternberg's career, without probably having known him in life, but these modest ceremonies today mark the completion of his personal monument and are fittingly celebrated by his personal friends.

I shall not attempt to rehearse the scientific work of General Sternberg with which the world is familiar, but only wish to call attention to one side of his career, yet one on which I believe much of his success was based, and which illustrates a lesson to every medical man who desires to serve his country in the military and naval services.

General Sternberg was a plain medical officer, a "soldier doctor," as the frontier expression used to go, before he became a scientist and an administrator. He served in his junior grades with troops in battle. He coped with a cholera epidemic in troops en route overland to the Far West. He was post surgeon and camp surgeon and performed the routine of his office, as we all have had to do—"the daily round, the common task"—without complaint, efficiently and to the satisfaction of his superiors. He must have had the potential mind of a scientist and the capacity for clear thinking, the tendency for social service and the tireless industry which marked his career throughout, and yet these first years of military service were not to my mind wasted, but, on the contrary, formed a firm foundation for the many-sided activities of his later life when he rose to the first place in the Medical Department and to the highest grade in American science.

The habits of obedience, self-reliance, and of doing things under adverse surroundings and with imperfect equipment are valuable qualifications for all men. They may be gained and are gained by every man worth his salt in military service, and he who has formed these habits is ready when opportunity knocks at the door.

Opportunity came to General Sternberg; he seized it, and the "soldier doctor" became the scientist and the administrator. His first policy as Surgeon-General, and on the whole, I believe, his greatest service to the Army, was the prompt provision he made for the laboratory research at every military post in the country and the establishment of the Army Medical School, which offered to every new officer a basic military-medical training. He gave to every medical officer an opportunity to begin at least the study of the new and rapidly growing sciences of bacteriology and preventive medicine. The results of his policy are now history, and have caused to be written the fairest pages in the annals of the Medical Corps.

The lesson of his accomplishment is for our younger officers of the permanent establishment. No matter what the mental equipment and the technical training of the newly entered medical officer may be, unless he has had the humble and inconspicuous life of a "soldier doctor" with troops, caring for his men, learning the routine of Army custom, Army law and Army drudgery, he will be crippled seriously when time brings him high rank and great responsibility. He need never fear that opportunity will not occur. Talent and ability are not so common as to make it at all probable that they will be overlooked.

I have had it overwhelmingly impressed on me many times during the war, how large was our need for men with scientific knowledge indeed, but who also were trained soldiers and administrators. I have thanked God many times for those we had and for the Army Medical School, which General Sternberg inaugurated and which helped to form these men into a small body of loyal, faithful and efficient public servants—a body that assured success in our efforts.

The great medical profession of the United States gave our men such care as no army has ever received. The treatment of sick and wounded, the prevention of disease and even administration was in preponderating measure accomplished by men with little or no previous military training, but our possession of a trained body of regular medical officers made it possible to coordinate effort and accomplish results of which the nation may well be proud and which could not have been attained without such a body. We worked together with our companions from civil life as brothers, and as brothers we hope to live together in the future, in peace or in war.

My impression of General Sternberg is preeminently that of a "useful" man; one who exemplified the best of our American qualities—a desire to work for the common good in any way that suggests itself. Self-contained, clear thinking and industrious, he loved to help out, or as I heard him express it, "lend a hand." As a soldier, physician, scientific investigator, social worker in Washington, his life was marked by usefulness.

All honor, then, to his memory, and may those of the younger generations who see this stone in future years be strengthened in their desire to serve the country and the people honestly, efficiently and tirelessly as did the man who lies buried here.

STERNBERG THE MAN

Col. Edward L. Munson, M. C., U. S. Army, dwelt on the human qualities of General Sternberg:

As the only member of General Sternberg's official family remaining on the active list, it has fallen to me to say a few

words on the qualities that made him respected as an officer, honored as a chief and beloved as a friend.

As the boy is father of the man, so the sterling qualities established in early life developed in General Sternberg the fruition of maturity. As a boy, the difficulties he encountered and overcame served to strengthen in him the qualities of inquiry, idealism and perseverance which brought about the achievements of later life.

Born in 1838, he received his early education at Hartwick Seminary, Otsego County, N. Y., a Lutheran institution, of which his father, Rev. Levi Sternberg, was president, and in which his maternal grandfather was a professor. In this academy, with its high ideals, strong religious influences and simplicity of living, his youth was passed. That here was laid his foundation of lofty purpose, of tireless industry, of right and justice, of human understanding and sympathy, and of reverent piety and practical Christianity, is undoubted. Reinforcing the academic influence was the home atmosphere and parental love, softening the austerities of the religious ideas of the day. Sprung from German stock which had been American for several generations, he had inherited the patriotism and traditions of ancestors who fought as soldiers in the Revolutionary War and had been high in the patriotic organizations of the time.

At 16 years of age, the needs were such that he became self-supporting, and taught school at Germantown, N. J. Here the qualities of initiative, confidence and self-reliance were further stimulated by being charged with the direction and welfare of others. For three years he continued this work, building up his own character as he molded that of his pupils.

Of scientific bent and that human sympathy which satisfied itself only in serving others, it was only natural that he should select a career in life which offered the best opportunity for the exercise of both qualities. This, the practice of medicine and surgery, he entered on at the age of 19 years, assisting in the office of Dr. Horace Lathrop of Cooperstown, N. Y., and graduating from the College of Physicians and Surgeons in New York in 1860. He immediately began the practice of his profession in Elizabeth, N. J.

On the outbreak of the Civil War shortly after, the patriotism of General Sternberg made him one of the first to offer his services to his country, and May 28, 1861, he was commissioned an assistant surgeon in the Army. There followed four years of war in which he shared the fortunes and honors of many campaigns and worthily carried responsibilities beyond his years. He learned to know men and human nature as a result of opportunities such as few enjoy. Then came decades

of service against Indians on frontier stations and in the older settled districts, in which he learned his country by contact with its elements as he had learned to know its men. He learned, too, to make the most of opportunity, to rise above the temporary disappointments incident to the service and to appreciate that interruption merely delays and does not thwart purpose. With his scientific instinct, difficulty merely furnished further incentive to effort, and lesser duties, well performed, were made to serve their purpose as stepping stones to higher things. Contact with the men of science whom he sought out gave him knowledge and incentive as he, on his part, served as an inspiration to them. In the honors which came to him he was still modest and unassuming.

And so, in well-rounded personality and character and in vigorous maturity, he came to be chief of his corps. As such, the qualities he had developed came into official expression. The scientific spirit was aroused, professional ability was promoted. A just guiding hand helped the weaker, while it opened the door of opportunity to the ambitious and zealous. A strong man's ideals were tempered by knowledge of human character and its weakness, and by a sympathy almost womanly in its character. Faced with the greatest war problems of a generation, he bore without reply the burden of many criticisms which were unfounded or due to faults not his own. For others he would not do that which he would not do for himself, and lest he be led away by preference or prejudice, he almost leaned backward in his sense of justice.

For all this, we of his staff, who knew him, his difficulties and successes best, admired and loved him and shall forever cherish his memory.

STERNBERG THE SCIENTIST

Col. Frederick F. Russell, M. C., U. S. Army, rehearsed the attainments of General Sternberg in the field of science:

I feel deeply how great an honor it is, to be permitted to add something to what has already been said about our former chief. When I entered the Medical Corps he was the Surgeon-General, and the memory of the first time I saw him is distinct and clear in my mind. Three of us, Ashburn, Pinkham and I, had just passed the ordeal of an Army examination board, and the recorder of the board, Colonel Munson, escorted us to the office of the Surgeon-General and presented us to General Sternberg, Colonel Alden and Colonel Smart. One of the three, Dr. Pinkham, knew the general more intimately than Ashburn and I, and he asked to be sent to Manila, and also that he might be furnished with one of the general's unit

laboratory outfits, which were at that time put up in packing cases in the depots, ready to be given to such members of the Medical Corps as were interested in the pursuit of bacteriology and sanitary chemistry. This led to a technical and intimate conversation regarding the variety of tropical diseases to be encountered there in Manila, and the desirability and need of accurate laboratory investigation of them. From my first day in the Corps, therefore, I knew that we had a chief who was an authoritative judge of the problems of preventive medicine in its broadest aspect. As time went on I learned more of his scientific work, and soon came to a realization and appreciation of the fact that in General Sternberg the Army and the country possessed a great contributor to scientific knowledge; and it is interesting to know that all his important contributions stand today, as true as when the work left his hands. General Sternberg was a contributor to our knowledge of medicine and biology in the true and best sense of the word. Not only have his statements of the results stood the test of time, but also his principles and in some cases his methods are still in use.

The work of the pioneer is often rough and crude, yet that cannot be said of the work of General Sternberg. He was a pioneer in bacteriology in this country, and by careful reading and laborious experimentation he perfected methods and gained a satisfactory technic in bacteriology under most inauspicious circumstances. He was actively engaged in a general practice as an Army surgeon, often at isolated and detached posts, with frequent changes of station, yet, nevertheless, he continued his work and completed the solution of his problems in spite of the disadvantages under which he labored.

Those who knew and who worked with him in those days testify to his enthusiasm, his faith in his work and his untiring energy. Those who are bacteriologists will realize how perfect and reliable must have been his methods and the details of his technic to have permitted him to carry on his researches from year to year, at a time when he was almost alone in this country in this branch of medicine. Professor Abbott of Philadelphia has stated that he obtained his first knowledge of bacteriology from General Sternberg, and at that time there was none other in the United States capable of teaching it.

The soundness of General Sternberg's work as a bacteriologist can be judged more readily from three things: (1) his work on disinfectants; (2) on the thermal death point of bacteria, and (3) his investigation of yellow fever. Our elaborate methods of testing the value of disinfectants and antiseptics

all date from his early work which was done under the auspices of the American Public Health Association and was published as the Lomb prize essay. It is difficult for us, at this time, to imagine the confusion surrounding the subject of disinfection. Then no one had any valid proof of the differential value of those agents, and one man's work was as good as another's. General Sternberg was the first one to bring order out of chaos, and little has been done since his time except to add refinements of technic. His work on the thermal death point of bacteria stands today almost exactly as it left his hands, and in our daily work we still use the ingenious methods he elaborated.

In his long and active life he made many other contributions to our knowledge, and one of the most interesting relates to his discovery of the micrococcus of pneumonia, or as he at first called it, the micrococcus of sputum septicemia. He demonstrated, in the sputum of normal healthy persons, by means of animal inoculations, the presence of an encapsulated, gram-positive micrococcus, and showed that it was capable of causing a fatal septicemia in rabbits and mice. He cultivated the organism and described its cultural and biologic characteristics. He did not, however, associate it with any disease process in human beings; that remained to be done several years later by Fränkel. It has sometimes seemed to me that perhaps a lesson might be drawn from this experience which would be of value to us today. It should be remembered that in 1880, when Sternberg discovered the micrococcus of pneumonia, the whole United States Army consisted of less than 25,000 persons, less than one division of our Army today, and that these men were scattered in small groups over the whole United States, and that it did not fall to the lot of any single army surgeon to have very much clinical material to investigate. It is reasonable to suppose that had he had the clinical opportunities which Fränkel had, or which we now have in our larger army hospitals, the completion of the history of his micrococcus would not have been delayed so long. The lesson for us is to arrange our work so that every medical officer will have, to the greatest possible extent, intimate and continuous contact with clinical and pathologic material during the greater part of his service in the corps.

The other subject with which General Sternberg's name will be always associated is yellow fever. He was the surgeon at Fort Columbus, Governor's Island, New York Harbor, in 1871, during an outbreak of yellow fever, and later because of his familiarity with the disease was sent to the Gulf Coast, where he passed through several epidemics of the disease, finally contracting it himself. His first scientific paper of

importance deals with the clinical aspects of cases of yellow fever. His interest in the subject never flagged and he added, gradually, pathologic and bacteriologic studies to the clinical. When there was no longer any case of yellow fever in the United States for study, he went to Havana and other tropical ports where the disease was endemic, and there made careful and complete studies of its bacteriology and pathology. He followed to its end one clue after another, and was so familiar with the entire question of the etiology that he was able to disprove, time and again, the claims of Freire of Brazil, of Finlay of Havana and of Sanarelli and many others that they had discovered the causative organism. Time has shown the truth and justice of all his statements. The history of yellow fever has now, after almost fifty years' work, been completed with the discovery of its cause by Dr. Noguchi.

It is more than merely interesting to trace the steps of the work: It started with General Sternberg in 1871; he exhausted all the possibilities there were, using the methods of investigation then known, and finally took the position that the organism must be ultramicroscopic. After he became Surgeon-General, in 1893, it was no longer possible for him to conduct his researches in person, yet his interest never abated, and when, in 1900, the disease again became a menace to our Army, he organized a yellow-fever commission and placed Walter Reed at its head. The commission demonstrated conclusively and for all time the method of transmission of the disease by mosquitoes. This investigation stands as one of the most brilliant ever made in medicine. The third step followed directly and consisted in the application, by General Gorgas, of the principles discovered by Reed's commission to the condition existing in Havana. This step was also brilliantly successful, and led to the complete eradication of the yellow plague, first from Havana, and later from most other Gulf ports, including Colon and Panama on the Isthmus. The fourth and last step has been taken so recently that all may not be aware of it. A yellow-fever commission, of which General Gorgas is the head, was organized by the International Health Board of the Rockefeller Foundation, and this commission sent Dr. Noguchi to Guayaquil to study the etiology of the disease. He was also successful and demonstrated an organism, which he christened the *Leptospira icteroides*, as the cause of yellow fever. He has reproduced the disease in animals and has developed a vaccine for prophylactic use and a curative serum for therapeutic use.

So we may now agree that the story of yellow fever is concluded, and we can see the definite separation of the story into four chapters, the title, the theme, and the opening one

being written by General Sternberg, and the other being written by a direct line of three others, Reed and Gorgas having worked under Sternberg and Noguchi under Gorgas. I can think of no other disease whose whole history, from the beginning to the end of its serious investigation, has been written by a single small and closely connected group in America, without a single contribution of value from any one else. It seems as though the impetus which General Sternberg gave the investigation was sufficient to inspire each of his successors in turn to a successful consummation of his own particular problem.

In looking back over the history of the Medical Corps, it is evident that the appointment of General Sternberg to the Surgeon-Generalcy in 1893 marks an epoch. With him came the new medical and new scientific knowledge. As a true scientist he believed in applying the experimental method to the art of medicine, and besides making contributions to our knowledge himself, he made it possible for others to carry on investigations also. He established the Army Medical School in 1893, built and rebuilt many of our army hospitals and included in the plans rooms for laboratories and better operating rooms. And from that time it has been possible for any medical officer in the Army to improve himself in the science and the art of medicine and surgery.

Any one would be justified in stating that the renaissance of scientific medicine in the Army dates from the beginning of his administration.

STERNBERG THE PHILANTHROPIST

General Sternberg's philanthropic works were recounted by Dr. George M. Kober:

We had hoped that Prof. William H. Welch would be present to speak of Dr. Sternberg's scientific work. The following letter explains his absence:

"It is with extreme regret that I find myself unable to be present at the unveiling of the General Sternberg memorial, Wednesday, November 5. There is an important meeting on that afternoon at our school of hygiene and public health which I must attend. I hope that Mrs. Sternberg and others will understand that no ordinary circumstances would prevent me from paying my tribute of respect to General Sternberg, to whom I was greatly attached and whose memory I revere."

Dr. Welch's appreciation of General Sternberg's scientific work is beautifully expressed in the epitaphs on the monument, which he indited in association with other medical officers of

the Army.¹ But like the great and good man that Dr. Welch is, he gladdened the evening of Dr. Sternberg's life, as shown by the following extracts from a letter dated April 13, 1910:

"I regard you as the real pioneer of modern bacteriologic work in this country, and I have always admired the way in which you mastered the technic and the literature of the subject and made yourself an important contributor to the development of the new science by sheer perseverance and native ability under circumstances which would have discouraged one of less force and aptitude for the study of nature."

Admiral Stitt of the U. S. Naval Medical School writes: "As must be true of all other workers in bacteriology, I consider Dr. Sternberg's as the greatest name in American bacteriology."

Prof. W. T. Councilman of Harvard Medical School writes under date of October 28: "It is fitting that the life and work of General Sternberg should be written and the greatness of the man and his work be made fully known. It was an arduous life directed by noble purpose."

It was my fortune to be closely associated with him for a number of years, and during this time I learned to have deep respect and admiration for him, together with a warm personal feeling of fondness. He was a most tireless investigator, shrinking from no difficulty which presented itself and never thinking of privation. He has left the record of a noble life and his work has brought truth nearer to man."

Dr. Sternberg was not only a great scientist; he was also a philanthropist in the fullest and most beautiful meaning of the word. A review of his scientific work shows that he always sought the application of science to the amelioration of human ills. His first important work in bacteriology was on disinfectants and disinfection as a means of preventing the so-called germ diseases, a work of incalculable value to mankind. He never lost an opportunity to impress on the profession and the public that the eradication of preventable diseases is the highest aim of scientific medicine.

1. Pioneer American Bacteriologist. Distinguished by his studies of the causation and prevention of infectious diseases, by his discovery of the microorganism causing pneumonia, and scientific investigations of yellow fever, which paved the way for the experimental demonstration of the mode of transmission of this pestilence.

Veteran of three wars, Brevetted for bravery in action in the Civil War and Nez Percés War. Served as Surgeon-General of the U. S. Army for a period of nine years, including the Spanish War. Founder of the Army Medical School. Scientist, Author and Philanthropist, M.D., LL.D.

It was not possible for a man of Dr. Sternberg's humanitarian attributes to rest content with the scientific knowledge that polluted water and impure milk are potent factors in the spread of typhoid fever and that insanitary houses and low standards of living are largely responsible for the prevalence of tuberculosis, but he must make practical application of this knowledge.

We therefore found him in the front rank and as a leader in the campaign for pure water and milk, removal of slums and the erection of sanitary homes in the National Capital. As a result of his efforts the Washington sanitary housing companies were organized, which have provided healthful homes at reasonable rates for over 800 wage earners and their families. The success of this enterprise led to a reproduction of these houses on even a larger scale in this and other cities, and secured for him a gold medal at the International Exposition held in Paris in 1900.

Dr. Sternberg fully appreciated that the health of a community depends in a large degree on the efficiency of the health officer, and when in 1900 there was danger of a change in the administration of that office, he enlisted the support of President McKinley in keeping the "right man in the right place." He was also ever helpful in securing additional appropriations for the maintenance of an efficient health service. All of this was done while he held the position of Surgeon-General. When, in June, 1902, he retired from his official position, instead of taking his ease, he remained a scientist, a practical worker and a fighter in the first ranks against disease and poverty.

Having been the first in America to demonstrate the tubercle bacillus discovered by Koch, in 1881, and familiar with the cause and prevention of tuberculosis, it was natural that he should labor long and faithfully in the campaign against this disease. He was a charter member of the National Association and president of the local Society for the Study and Prevention of Tuberculosis. During this time he was the leader of a great educational campaign: he established several dispensaries, urged the erection of the municipal hospital for indigent patients and also established a sanatorium for the middle-class victims of this disease. He was also instrumental in securing the enactment of a law providing for the condemnation of houses unfit for human habitation, and the compulsory registration of tuberculous patients.

The influence of his beneficent work is shown by the fact that the tuberculosis death rate in this city has been reduced among the colored population from 492 per 100,000 in 1900, to 312 in 1917, and the death rate among the white population from 188 in 1900, to 93 in 1917.

In 1907 he was chairman of President Roosevelt's homes commission, which submitted a report of lasting value in matters relating to housing, social and industrial betterment. Dr. Sternberg was also a member of the committee on organization of the International Congress on Tuberculosis held in Washington, in 1908, and of the Fifteenth International Congress on Hygiene, Sept. 16-Oct. 5, 1912.

He worked assiduously with all organizations striving for the establishment of higher standards of living so that the physical development of the nation may be more perfect, life more vigorous, decay less rapid and death more remote. Dr. Sternberg had lived a lifetime of service to his fellow men, as shown by his scientific and practical contributions to preventive medicine, his participation in the eradication of preventable disease and his kindly ministrations to the sick and distressed. In all these activities his only protest against cares was silence. Dignity met his responsibilities, humility and equanimity his successes and disappointments. He leaves a memory of patriotism and good citizenship, a memory of brotherly love and good deeds.

BIBLIOGRAPHY OF GEORGE M. STERNBERG

(Prepared by Mr. Cary R. Sage, Library of the Surgeon-General's Office,
Washington, D. C.)

— 1875 —

An Inquiry Into the Modus Operandi of the Yellow Fever Poison,
New Orleans M. & S. J. (n. s.) 3:1-23 (July) 1875.

Observations upon the Urine in Yellow Fever, New Orleans M. & S. J.
(n. s.) 3:197-202, 1875.

— 1877 —

A Study of the Natural History of Yellow Fever and Some Remarks
upon the Treatment Based upon the Same; with Cases and Tables
of Observations upon the Temperature and Urine, New Orleans M.
& S. J. (n. s.) 4:638-674, 1877.

— 1879 —

On Yellow Fever (Abstr.), Tr. Epidemiol. Soc. Lond. 4:39-52, 1879.
Photomicrographs, Washington, 1879.

The Public Health Association and Yellow Fever, Med. Rec. 15:45,
1879.

Experiments Designed to Test the Value of Certain Gaseous and
Volatile Disinfectants, National Bd. Health Bull. 1:219, 227, 287,
365, 1879.

Preliminary Report of the Havana Yellow Fever Commission of the
National Board of Health, Submitted Nov. 18, 1879 (with
S. E. Chaillé), National Bd. Health Bull. 1: Suppl. No. 1, 1-19,
1879.

— 1880 —

The Microscopical Investigations of the Havana Yellow Fever Com-
mission, New Orleans M. & S. J. (n. s.) 7:1017-1024 (May) 1880;
Proc. Am. Assn. Advance. Sc. 29:381-386, 1881.

The Diagnosis of Yellow Fever; Yellow Fever and Quarantine, New
Orleans, L. Graham & Son, 1880.

Report of Microscopical Examination of Suspended Particles Found
in the Atmosphere, National Bd. Health Rep. 2:387-396, 1880.

Yellow Fever and Quarantine, Am. Pub. Health Ass. Rep. 6:351-357,
1880.

Reports in Regard to a Form of Fever Recently Prevailing on the
Lower Mississippi River (with J. Dickson Bruns and John P.
Davidson), New Orleans M. & S. J. 8:382-398, 1880.

A Letter, New Orleans M. & S. J. (n. s.) 8:482-487, 1880.

— 1881 —

A Prediction Verified, Phila. M. Times 11:592, 1881.

A Fatal Form of Septicaemia in the Rabbit, Produced by the Sub-
cutaneous Injection of Human Saliva, National Bd. Health Bull.
2:781-783, 1881; National Bd. Health Rep. 3:87-92, 1881; Johns
Hopkins Univ. Stud. Biol. Lab. 2:183-200, 1882; Tr. Med. & Chir.
Fac. Maryland 63:210-219, 1881.

Bacillus Anthracis, *Am. Month. Micr. J.* **2**:148 (August) 1881.

Fiebre amarilla; informe preliminar que a nombre de la comision americana para el estudio de la fiebre amarilla han presentado el 18 de noviembre de 1879 al Consejo Nacional de sanidad de los Estados Unidos (with S. E. Chaillé), *Bol. de med. nav., San Fernando* **3**:225, 258, 277, 1880; **4**:53, 77, 137, 169, 219, 245, 1881.

An Instructive Experiment, *Med. Rec.* **20**:339, 1881.

What is the Explanation of the Protection from Subsequent Attacks Resulting from an Attack of Certain Diseases, and of the Protective Influence of Vaccination against Smallpox? *Am. J. M. Sc.* **81**:373-378, 1881.

Yellow Fever, *Cycl. Pract. Med. (Ziemssen) Suppl.*, 45-73, 1881.

Experimental Investigations Relating to the Etiology of the Malarial Fevers, *National Bd. Health Bull.* **3**: Suppl. No. 14, 1-11, 1881; *National Bd. Health Rep.* **3**:65-86, 1881.

— 1882 —

Experiments with Disinfectants, *National Bd. Health Bull.* **3**:21, 68, 1881; *Johns Hopkins Univ. Stud. Biol. Lab.* **2**:201-212, 1882.

Bacteria and the Germ Theory of Disease, *Tr. M. Soc. Calif.* **12**:193-198, 1882.

Bacterial Organisms, *Western Lancet* **11**:198-203, 1882.

A Contribution to the Study of the Bacterial Organisms Commonly Found on Exposed Mucous Surfaces and in the Alimentary Canal of Healthy Individuals, *Johns Hopkins Univ. Stud. Biol. Lab.* **2**:157-181, 1882; *Proc. Am. Assn. Advance. Sc.* **20**:83-94, 1882; French translation: *J. de microgr.* **7**:129-140, 1883.

Induced Septicaemia in the Rabbit, *Am. J. M. Sc.* **84**:69-76, 1882.

Is Tuberculosis a Parasitic Disease? *Med. News* **41**:6, 87, 311, 564, 730, 1882.

The Recognition of Micrococci, *Med. Rec.* **21**:368-370, **22**:429, 1882.

The Value of Carbolic Acid as a Germicide as Established by Experimental Data, *Med. Rec.* **22**:314-317, 1882.

Virulence of Normal Human Saliva, *Phila. M. Times* **12**:836-839, **13**:80-82, 1881; *Med. News* **41**:332-334, 1882.

Malaria, *Sanit. Engin.* **7**:126, 147, 172, 1882.

— 1883 —

Experiments to Determine the Germicide Value of Certain Therapeutic Agents, *Am. J. M. Sc.* **85**:321-343, 1883.

The Micrococcus of Gonorrheal Pus, *Med. News* **42**:67, 96, 323, 1883.

Photomicrographs and How to Make Them, Boston, J. R. Osgood & Co., 1883.

— 1884 —

Malaria, *Am. Pub. Health Ass. Rep.* **9**:31-54, 1883; *Med. Rec.* **25**:253, 281, 1884.

Bacteria, New York, William Wood and Co., 1884.

Further Experiments with the Micrococcus of Gonorrheal Pus, "Gonococcus" of Neisser, *Med. News* **45**:426-429, 1884.

Malaria and Malarial Diseases, New York, William Wood and Co., 1884.

Disease Germs, Am. Pub. Health Ass. Rep. 10:69-78, 1884; Med. Rec. 26:451-455, 1884.

— 1885 —

American Public Health Association. Preliminary Report on Disinfection and Disinfectants made by the Committee on Disinfectants (April), 1885.

Commercial Disinfectants, Med. News 46:144-147, 1885.

The Comparative Antiseptic Value of the Salts and Oxides of Mercury, Med. News 47:287, 1885.

The Destruction of Cholera Germs, in *A Treatise on Asiatic Cholera*, edited by E. C. Wendt, New York, 1885, pp. 325-335.

Disinfectants, the Metallic Sulphates, Med. News 47:204, 1885.

The Germicide Power of Potassium Permanganate, Med. News 46:30-35, 1885.

Injection of Finely Powdered Inorganic Material Into the Abdominal Cavity of Rabbits Does Not Induce Tuberculosis; an Experimental Research, with Pathological Notes by W. T. Councilman, Am. J. M. Sc. (n. s.) 89:17-30, 1885.

Poisonous Cheese, Board Health Mich. Rep. 13:218-220, 1885.

The Pneumonia Coccus of Friedländer (*Micrococcus Pasteuri*, Sternberg), Am. J. M. Sc. (n. s.) 90:106-123, 435-438, 1885; also appendix to See, Germain: Diseases of the Lungs, New York, 1885.

Practical Experiments on the Sterilization of Feces, Med. News 47:368, 1885.

Reply to Dr. Duggan, Med. Rec. 28:643, 1885.

What Is the Explanation of Acquired Immunity from Infectious Diseases? Lancet 1:655, 696, 1885.

— 1886 —

Disinfection and Individual Prophylaxis Against Infectious Diseases, Concord, N. H., 1886; Am. Pub. Health Assn. Pub. Health, The Lomb Prize Essays, 1886, pp. 99-136; Rep. Board Health Calif., Sacramento 9:241-270, 1884-86; German Translation, 1886; Danish Translation, Biblioth. f. Læger 17:185-242, 1887; Portuguese Translation, Rio de Janeiro, Laemert & Co., 1889. Revised in December, 1899, Columbus, Ohio, Berlin Printing Company, 1900.

The Bacillus of Typhoid Fever (*Typhus Bacillus* of Eberth), Med. News 49:197-202, 1886.

Bacteriological Notes, Med. News 48:678, 706, 1886.

Inoculation Experiments with Rabies Virus at Baltimore, Med. News 48:675, 1886.

The Malarial "Germ" of Laveran, Science 7:297-299, 1886; Med. Rec. 29:489, 517, 1886.

Micrococcus Pasteuri, Am. J. M. Sc. (n. s.) 92:123-131, 1886; J. Roy. Microsc. Soc. (2d s.) 6:391-396, 1886.

Pasteur's Method for the Prevention of Hydrophobia, Med. News 48:449-453, 1886.

—1887—

- American Public Health Association. Fifteenth Annual Meeting: The Annual Address, *Med. News* **51**:557-561, 585-589, 1887; *Am. Pub. Health Assn. Rep.* **13**:1-21, 1887.
- American Public Health Association. Committee on Disinfectants, 1887: Report of the Chairman of the Committee, *Am. Pub. Health Assn. Rep.* **13**:64-201, 1887.
- The Bacillus of Typhoid Fever, *Med. News* **50**:482-486 (April 30) 1887.
- The Liquefaction of Gelatine by Bacteria, *Med. News* **50**:372, 1887.
- Der Micrococcus der Sputumsepticaemie (M. Pasteuri, Sternberg), *Deutsche med. Wchnschr.* **13**:44, 1887.
- The President's Address, *Am. Pub. Health Ass. Rep.* **13**:1-21, 1887.
- The Thermal Death-Point of Pathogenic Organisms, *Am. J. M. Sc.* (n. s.) **94**:146-160, 1887.

—1888—

- Fiebre amarilla: comunicacion á la Academia, *Rev. de cien. méd. Habana*, No. 40, 10, 1888.
- Investigations Relating to the Etiology and Prophylaxis of Yellow Fever, *Tr. Coll. Phys. Philadelphia* (3d s.) **10**: 339-365, 1888; *abst. Med. News* **52**:449-456, 1888.
- Investigaciones sobre fiebre amarilla, *An. r. Acad. de cien. méd. de la Habana* **25**:59-63, 1888; *Crónica méd.-quirurg. de la Habana* **14**: 335-337, 1888.
- Preliminary Note on a New Method of Treating Yellow Fever, *Therap. Gaz.* (3d s.) **4**:524-526, 1888.
- Recent Researches Relating to the Etiology of Yellow Fever, *Tr. Ass. Am. Physicians* **3**:321-329, 1888; *abst. J. A. M. A.* **13**:771-773, 1889; *Am. Pub. Health Ass. Rep.* **15**:170-172, 1889.

—1889—

- Additional Note on the Treatment of Yellow Fever, *Therap. Gaz.* (3d s.) **5**:388, 1889.
- Bacillus Diphtheriae (Loeffler), *Brooklyn M. J.* **3**:145-153, 1889.
- Bicarbonate of Sodium and Bichloride of Mercury in the Treatment of Yellow Fever, *Therap. Gaz.* (3d s.) **5**:298-304, 1889.
- The Treatment of Yellow Fever with Sodium Bicarbonate and Mercuric Chloride, *Johns Hopkins Hosp. Bull.* **1**:68, 1889.
- The Etiology of Croupous Pneumonia, *Med. Rec.* **35**:281, 309, 1889; *Lancet* **1**:370, 420, 474, 1889; *Tr. M. Soc. New York*, 53-80, 1889; *National M. Rev.* **7**:175-177, 1898; *J. Pract. Med.* **8**:306, 1898.
- Hunting Yellow Fever Germs, *Med. News* **54**:253-256, 1889; *Proc. Quarant. Confer.*, 90-102, 1889.
- Report on the Prevention of Yellow Fever by Inoculation, Made in Compliance with Instructions from the President of the United States, and in Accordance with an Act of Congress Providing for the Civil Expenses of the Government for the Year Ending June 30, 1888, Submitted in March, 1888, *Rep. Superv. Surg.-Gen. Marine Hosp. Service*, 135-239, 1889.
- Etiologia de la fiebre amarilla, *An. r. Acad. de cien. méd. de la Habana* **26**:227-230, 1889-1890.

— 1890 —

- Dr. Freire's Protective Inoculation: Facts Versus Figures, *Med. Rec.* **37**:524-526, 1890.
Cocoanut-Water as a Culture Fluid, *Med. News* **57**:262, 1890.
Facts Versus Figures, Yellow Fever Inoculation, *J. A. M. A.* **15**:142-144, 1890.
Report on the Etiology and Prevention of Yellow Fever, Washington, 1890.
Report on the Sanitation of Ships and Quarantine. Prepared by the Supervising Surgeon-General, U. S. Marine Hospital Service (with John B. Hamilton, Surg-Gen.), Rep. U. S. Marine Hosp. Service **18**:85-95, 1890. Sen. Exec. Doc. 121, 51st Cong., 1st Sess.
Bacteriological Researches in Yellow Fever, *Tr. New York Acad. M.* (2d s.) **7**:313-316, 1890.

— 1891 —

- The Disinfection of Excreta, *J. A. M. A.* **17**:290-294, 1891.
Dr. Finlay's Mosquito Inoculations, *Am. J. M. Sc. (n. s.)* **102**:627-630, 1891.
Disinfection, in Hare's *System of Practical Therapeutics*, **1**:573-598, 1891.

— 1892 —

- The Biological Characters of the Cholera Spirillum—*Spirillum Cholerae Asiaticae* (Comma Bacillus of Koch)—and Disinfection in Cholera, *Med. Rec.* **42**:387-391, 1892.
Infectious Diseases, Causation and Immunity, *Popular Sc. Month.* **41**:616-635, 1892.
Micrococcus Pneumoniae Crouposae, *Med. News* **60**:153, 1892; *Lancet* **1**:682, 1892; *Centralbl. f. Bakteriöl. u. Parasitenk.* **12**:53-56, 1892.
Practical Results of Bacteriological Researches, *Am. J. M. Sc. (n. s.)* **104**:1-15, 1892.
Protective Inoculations in Infectious Diseases, *Tr. Am. Pub. Health Assn.* **18**:273-291, 1892; *Boston M. & S. J.* **128**:29, 56, 1893.

— 1893 —

- A Manual of Bacteriology, New York, Wm. Wood and Company, 1893.
Address to Members of Pan-American Medical Congress, *J. A. M. A.* **21**:369-375, 1893.
Disinfection at Quarantine Stations, Especially Against Cholera, *New York M. J.* **57**:57-62, 1893.
Bacteriological Report on Cholera, *Am. J. M. Sc.* **105**:388-393 (April) 1893.
How Can We Prevent Cholera? *Med. Leg. J.* **11**:1-8, 1893.

— 1894 —

- The Action of Sunlight on Micro-Organisms (with J. T. Dezendorf), *Med. Rec.* **46**:607, 1894.
The Bacteriology of Pylonephritis, *Am. J. M. Sc. (n. s.)* **107**:664-669, 1894; *Tr. Cong. Am. Phys. & Surg.* **3**:172-181, 1894.

— 1895 —

- Explanation of Acquired Immunity from Infectious Diseases, Science (n. s.) **1**:346-349, 1895.
- Immunity, Protective Inoculations in Infectious Diseases and Serum-Therapy, New York, Wm. Wood and Company, 1895.
- Introductory Address Delivered September 30 at the College Building, Georgetown University, District of Columbia, J. A. M. A. **25**:689-696, 1895.
- The Proofs of Progress, Med. Rec. **48**:508-512, 1895.
- Report of Immunity Against Vaccination Conferred on the Monkey by the Use of the Serum of the Vaccinated Calf and Monkey (with Walter Reed), Tr. Assn. Am. Physicians **10**:57-69, 1895.
- President's Address, Association of Military Surgeons, Proc. Assn. Mil. Surg. U. S. **5**:8-22, 1895.

— 1896 —

- The Practical Results of Bacteriological Researches, Popular Sc. Month. **48**:735-750, 1896.
- The Etiology and Classification of Infectious Diseases, Am. J. M. Sc. (n. s.) **112**:649-667, 1896.
- The History and Geographical Distribution of Yellow Fever, Janus **1**:195-201, 1896.
- Pasteur, Science (n. s.) **3**:185-189, 1896.
- Scientific Researches Relating to the Specific Infectious Agent of Smallpox and the Production of Artificial Immunity from This Disease, J. A. M. A. **26**:919-928, 1896; German Translation: Centralbl. f. Bakteriöl. 1 Abt. **10**:805, 857, 1896.
- A Textbook of Bacteriology, New York, Wm. Wood and Company, 1896; Second Revised Edition, New York, Wm. Wood and Company, 1901.

— 1897 —

- The Malarial Parasite and Other Pathogenic Protozoa, Popular Sc. Month. **50**:628-641, 1897.
- The Bacillus Icteroides of Sanarelli (Bacillus X, Sternberg), Am. J. M. Sc. (n. s.) **114**:303-322, 1897; German Translation: Centralbl. f. Bakteriöl. 1 Abt. **22**:145-166, 1897.
- Etiologia da febre amarella, Brazil med. **11**:196, 205, 1897.
- Preventive Medicine, Sanitarian **38**:193, 1897.
- Recent Researches Relating to the Etiology and Specific Treatment of Yellow Fever, Am. Pub. Health Assn. Rep. **20**:426-442, 1897; Med. News **71**:613-618, 1897.
- The Bacillus Icteroides of Sanarelli, Comptes-rendus 12e Cong. internat. de méd. **2**:120-137, 1897.
- Yellow Fever, in Loomis' *System of Practical Medicine*, **1**:267-300, 1897.

— 1898 —

- The Etiology and Geographic Distribution of Infectious Diseases, Popular Sc. Month. **52**:289-304, 1898.

- The Address of the President Delivered at the Forty-Ninth Annual Meeting of the American Medical Association, held at Denver, June 7-10, 1898, *J. A. M. A.* **30**:1373-1380, 1898; *Med. News* **72**:737-740, 1898.
- Answer to His Critics, *Med. News* **73**:335-337, 1898.
- Bacillus Icteroides* (Sanarelli) and *Bacillus X* (Sternberg), *J. A. M. A.* **30**:233, 1898; *Tr. Assn. Am. Physicians* **13**:61-72, 1898; German Translation: *Centralbl. f. Bakteriöl., etc.*, 1 Abt. **23**:769-777, 1898.
- The Bacteriology of Yellow Fever, *Johns Hopkins Hosp. Bull.* **9**:119, 1898.
- Dr. Klebs' Ameba of Yellow Fever, *J. A. M. A.* **30**:1054, 1898.
- The Malarial Parasite, *Youth's Companion* **72**:204, 1898.
- The Medical Department of the Army, *Med. Rec.* **54**:213-214, 1898; *Med. News* **73**:182, 1898.
- The Official Summary of the Annual Report of the Surgeon-General of the Army, *New York M. J.* **68**:793-798, 1898.
- The Sanitary Regeneration of Havana, *Century Magazine* **56**:578-583, 1898.
- The Work of the Army Medical Department During the Spanish War, *J. A. M. A.* **31**:1356-1360, 1898.

— 1899 —

- The Surgeon-General of the Army and the American National Red Cross, *National M. Rev.* **8**:252, 1899.
- Antivivisection in the District of Columbia, *Boston Med. and Surg. J.* **140**:198, 1899.
- The *Bacillus Icteroides* as the Cause of Yellow Fever: A Reply to Professor Sanarelli, *Med. News* **75**:225-228, 767, 1899.
- The *Bacillus Icteroides* (Sanarelli) and *Bacillus X* (Sternberg), *Centralbl. f. Bakteriöl.* 1 Abt. **25**:655-662, 1899; transl. *Crónica méd.quirurg. de la Habana* **25**:161-169, 1899.

— 1900 —

- Sanitary Lessons of the War, *J. A. M. A.* **32**:1287-1294, 1899.
- Surgeons Wanted in the Philippines, *New York M. J.* **71**:205-206, 1900.
- Yellow Fever and Mosquitos, *Brit. M. J.* **2**:1391, 1900.
- Yellow Fever Etiology, *J. A. M. A.* **35**:1039, 1900.

— 1901 —

- Malaria, *Popular Sc. Month.* **58**:360-371, 1901.
- The Transmission of Yellow Fever by Mosquitoes, *Popular Sc. Month.* **59**:225-241, 1901.

— 1902 —

- The Dinner to Dr. Sternberg (with Address by Dr. Sternberg), *Phila. M. J.* **9**:1120-1123, 1902.
- The Function of the Army Medical School, The Address at the Annual Commencement of the Army Medical School at Washington, April 4, 1902, *Am. Med.* **3**:547-551, 1902.

— 1903 —

- Preventive Medicine, Popular Sc. Month. **62**:348-358, 1903.
 Filth Diseases, Med. Mirror **14**:13-15, 1903.
 Infection and Immunity, with Special Reference to the Prevention of
 Infectious Diseases, New York and London, G. P. Putnam's Sons,
 1903.

— 1905 —

- Sanatorium Treatment, Washington M. Ann. **3**:305-308, 1905.

— 1906 —

- Preventive Medicine, George Washington Univ. Bull. **5**:55-64, 1906.

— 1907 —

- First Fifty Cases of Tuberculosis Treated at Starmont Sanatorium,
 Washington M. Ann. **5**:337-347, 1907.

— 1908 —

- Building of Model Houses. Report of the President's Homes Com-
 mission, Washington, 1908.
 Addresses Delivered at the Complimentary Banquet to General George
 M. Sternberg, M.D., LL.D., on His Seventieth Birthday, June 8,
 1908. Compiled and edited by Geo. M. Kober, M.D., Washington,
 [1908].

— 1910 —

- Housing of the Working Classes a Factor in the Prevention of Tuber-
 culosis, J Outdoor Life **7**:319-321, 1910.

— 1911 —

- The Results of Treatment at the Starmont (Tuberculosis) Sanatorium,
 Washington M. Ann. **10**:50-56, 1911.

— 1915 —

- Small Homes Within the City Limits for Unskilled Wage Earners,
 Second Edition, New York, National Housing Assn. Publ. No. 27,
 1915.
 Researches Relating to the Etiology of Yellow Fever, Pan-Am. Surg.
 and Med. J. **21**: no. 4, 16-20, 1916.
 Historical Résumé of the Investigations of Yellow Fever Leading Up
 to the Findings of the Reed Board, Proc. Pan.-Am. Scient. Cong.
10:645-652, 1917.

TRANSLATIONS

- Magnin, Antoine: The Bacteria, Boston, 1880; New York, 1884.
 Galtier, V.: Injections of the Virus of Hydrophobia Into the Circula-
 tion Do Not Produce Rabies and Seem to Confer Immunity from
 the Disease, Med. Rec. **22**:227, 1882.
 Abstract of the Conclusions Adopted and Propositions Rejected by the
 Technical Commission of the International Sanitary Conference of
 Rome. Translated from the French. Rep. U. S. Marine Hosp.
 Service, 278-303, 1886.
 Also Co-Editor of *A Treatise on Asiatic Cholera*, edited by E. C.
 Wendt, New York, 1885.

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